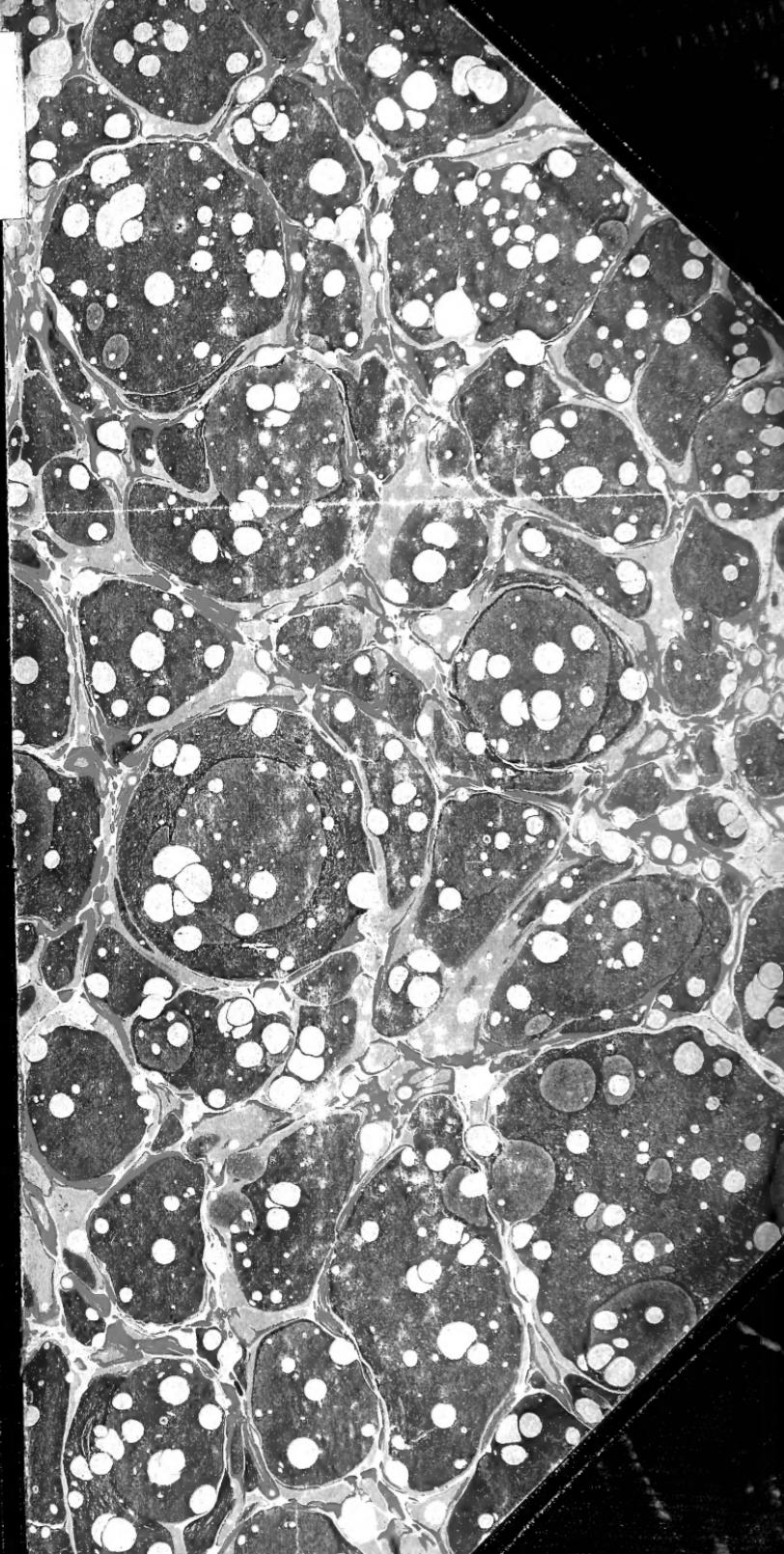
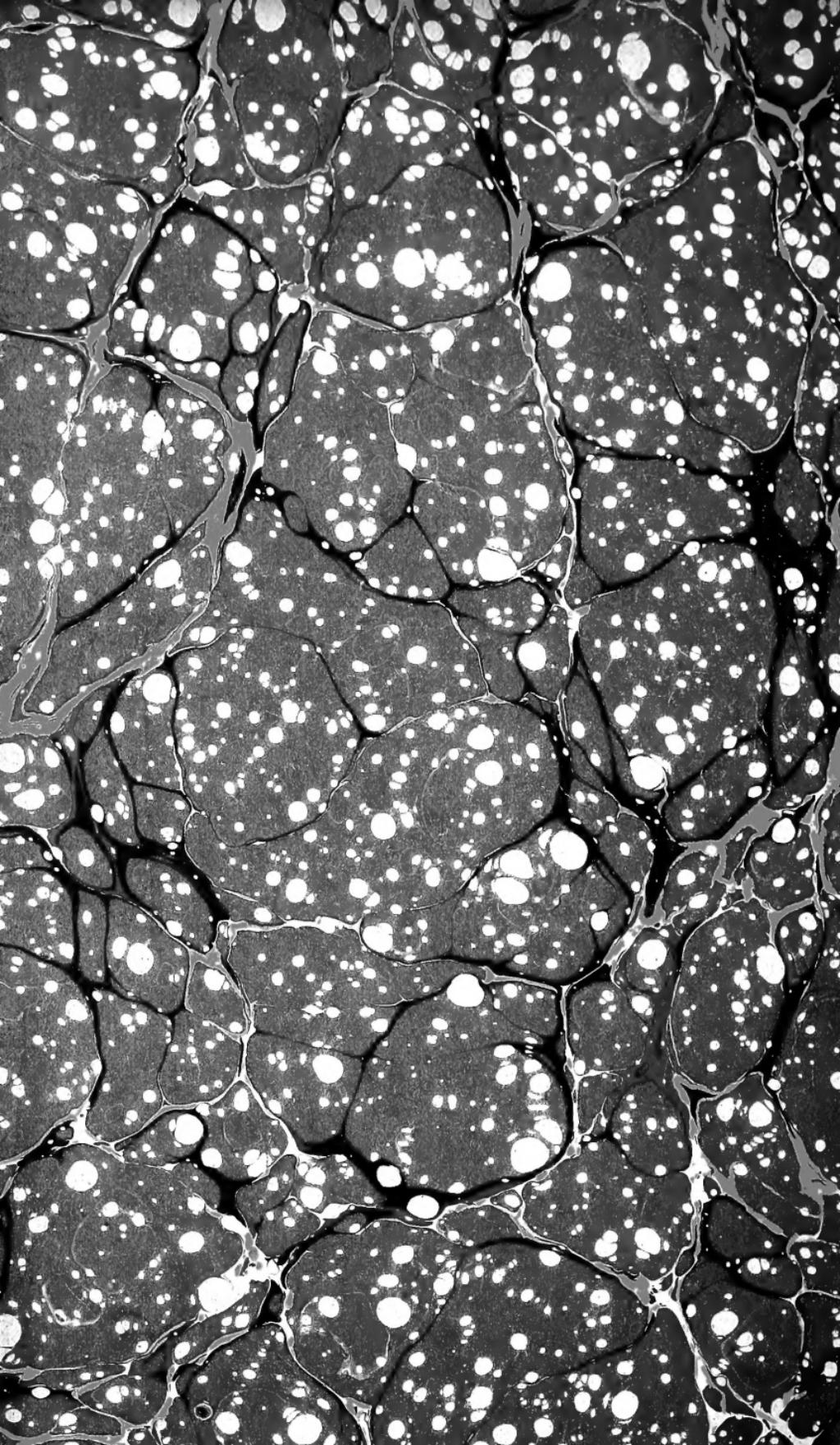


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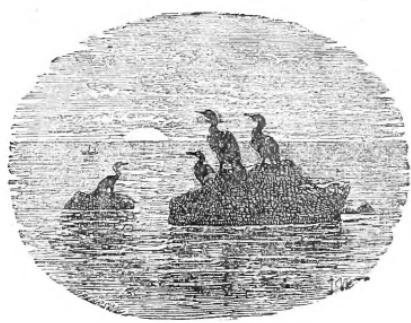
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P R E F A C E.

IN spite of the dread crisis this country, and to a certain degree the whole of civilization, is now encountering, zoology as a study is showing a marvellous amount of vitality; the Zoo gains a full attendance of visitors, and all our leading animal dealers are still in business; zoological periodicals maintain their issues, and, in particular, the 'Zoologist' not only does this, but, in the seventy-second year of its existence, shows itself as strong as ever it was, and very much stronger than it has been for many years. That the longer papers should come in regularly was only to be expected in the case of a journal so hospitable as ours has always been; what is particularly interesting and important as a sign of vitality is the abundance of short notes, which this year average nearly a dozen per month, a number far greater than has been approached for several years past. This is as it should be, and is in accordance with the character of the 'Zoologist' as the most typically English of zoological publications, and that which most nearly approaches the character of a national institution among them. For this relief from the fear which must necessarily overshadow a small specialist publication in troublous times like these, we owe sincere thanks to our supporters both new and old, to the contributors of long articles and short notes alike, and we feel that they share our gratification in the happy result to the magazine.

There is enough, too, to sadden us at this time quite apart from the world-war, for the hand of death has been heavy on those connected with zoology during the past year. Not only have we had to record the death of our proprietor, Mr. T. P. Newman, whose public-spirited maintenance of our Journal was of greater service to science than many a bulky volume that

has been published in its name ; M. Fabre, the great French entomologist, has gone ; Mr. R. Lydekker, the well-known palaeontologist and sound and dignified popularizer of the zoology of the higher groups ; Dr. E. A. Minchin, the celebrated protozoologist ; Mr. R. Barrington, the veteran Irish naturalist, whose first communication was made to the 'Zoologist,' which he steadily supported for many years with numerous notes ; and lastly, just as we go to press, we hear of the death of Mr. H. E. Dresser, most kindly and sensible of ornithologists, and the author of unrivalled works on the birds of Europe and of the palaeartic region generally. Most of these, it is consoling to reflect, had reached a ripe age, as students of our science so commonly do.

As against these melancholy happenings we have to record the publication of some most important and interesting works. Colonel T. Roosevelt's book on the 'Life-histories of African Big Game,' which, though by an American, is published here, with its philosophical criticisms of current theories, and Mr. J. L. Bonhote's book on 'Vigour and Heredity,' with its wealth of experiment and lucid exposition, will be much heard of yet and have a stimulating effect ; while Mr. A. Thorburn's magnificent book on 'British Birds,' still in progress, touches the high-water mark of excellence in production. Altogether, with much to grieve for, we have much cause for thankfulness ; Britons are holding their own in our science as well as in arms.

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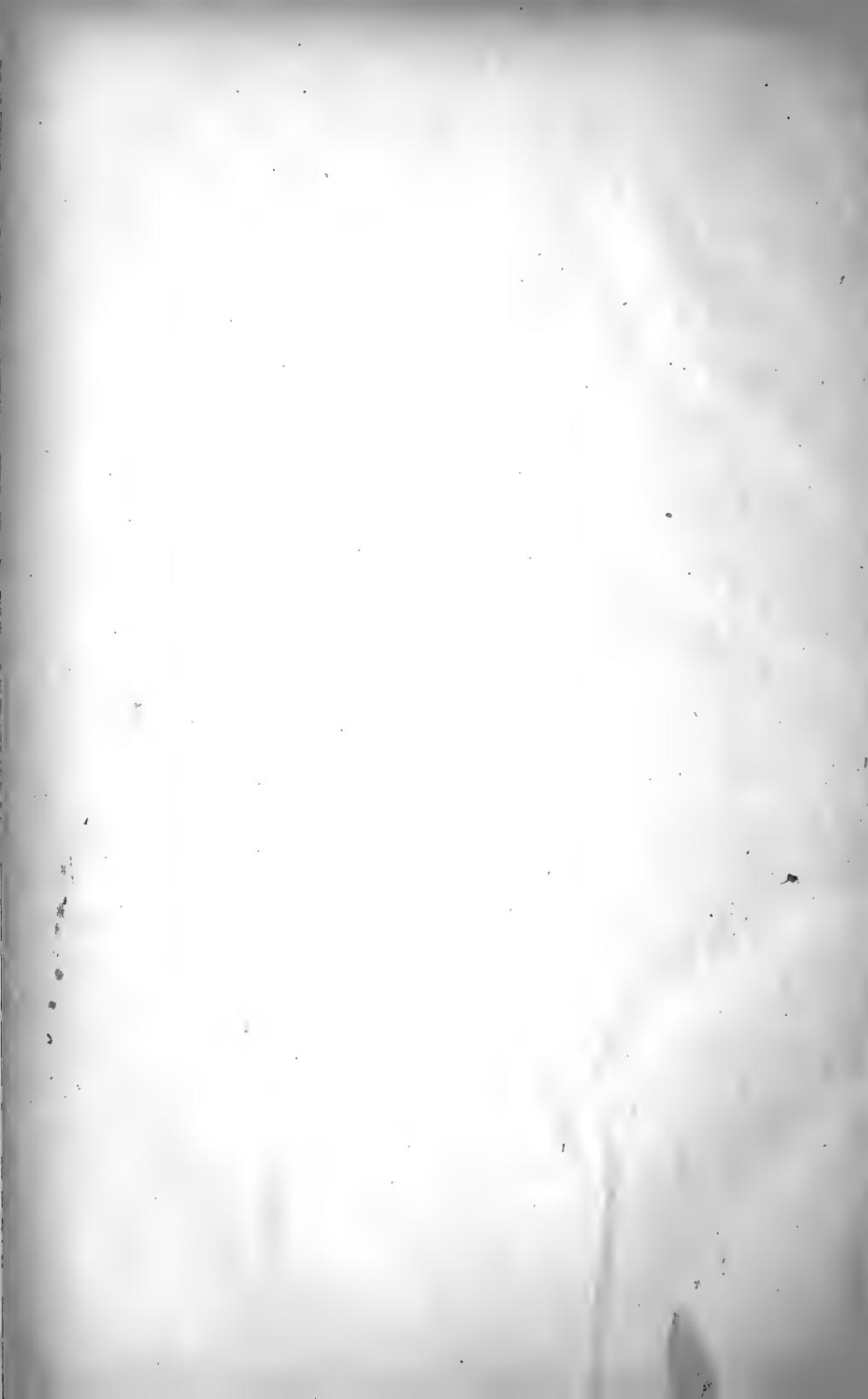
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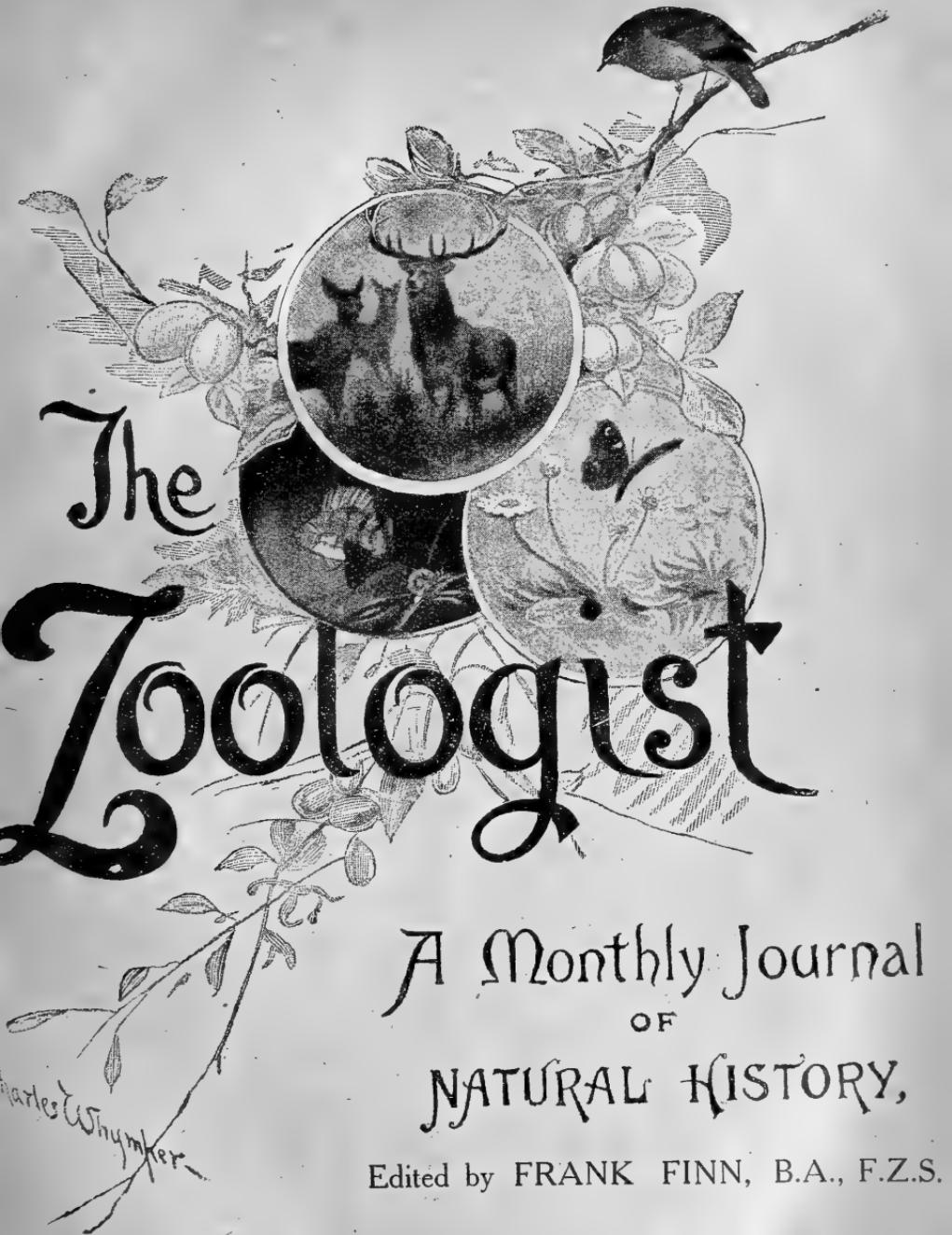
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THE ZOOLOGIST

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SOME FISH-NOTES FROM GREAT YARMOUTH AND NEIGHBOURHOOD FOR 1914.

By ARTHUR H. PATTERSON.

(Associate of the Marine Biological Association of Great Britain.)

JUST after my "Notes" for 1913 were sent to the 'Zoologist' I received a communication from Mr. E. R. Cooper, of Southwold, dated December 13th, in which he stated:—"This has been a record week in the history of spratting; during the seven days, including to-day, there have been landed in the harbour 2400 bushels, and probably during the same period 5000 bushels have been landed on the beach.* The price has also kept up well, from 3s. 6d. to 2s. 6d. per bushel; and considerable quantities are being pickled for export.† . . . The fish have been quite close to the shore, and it has been a sight to see the thousands of Gulls taking the Sprats as they come to the surface along the line of nets. The last two seasons there have been landed at harbour: 1911, 680 bushels; 1912, 1326 bushels."

I am afraid the time-honoured (?) practice of selling Sprats for manure still obtains; a great pity to practically waste so much nutritious food when other manures, both artificial and natural, are obtainable. I see no reason why British manufacturers should not utilize on a more considerable scale these

* Mr. Cooper, in a footnote, adds, "The fish landed on the beach are not tabulated."

† I believe German fish-buyers purchased great quantities for "tinning down."

fishes as Sardines as a substitute for juvenile Pilchards, just as immature Herrings have entered largely into the table dainty known as "Skipper Sardines," a most tempting and appetising form of food. Unfortunately, owing to elemental caprices of the Sprat season, the catches are not always to be relied upon.

On January 3rd (1914) we had a lot of Sprats sent to Yarmouth which had been "stow-netted"—a lack-lustre, scaleless, washed-out display of murdered fishes, contrasting strongly with the tempting "droves" taken in October and November in the drift-nets. As late as the 22nd these stow or "set" Sprats were still in evidence.

I met a fish-hawker with a barrow-load of small Herrings, little larger than Sprats, which did not look worth the trouble of cooking in any form. The man himself, who seemed half ashamed of his limp scaleless fishes, assured me that they were part of a catch sent semi-privately from Scotland to a larger buyer. They were trawled stuff, and a sad reflection on the greed that prompted the use of this net, especially upon such immature and useless fishes.

The local shrimpers got their boats and gear together exceptionally early this year, some of them putting out in the latter part of January. Their initial catches of "Pink Shrimps" (*Pandalus montagui*) were very small, and the crustaceans themselves not full-grown, although a considerable majority of them were berried. These men did very badly during the spring and summer months owing to the water being so "sheer" (clear), when the Shrimps and Prawns so easily see the approaching net and evade it. Moreover, immense hordes of small Whiting played havoc with these crustaceans. The Whiting were in evidence all along the East Coast, from the Humber to Aldeburgh. Dr. H. Laver, of Colchester, complained to me of the almost utter failure of the shrimping industry off the coast of Essex. He wrote (dated October 25th, 1914):—"I cannot think your explanation [the Whiting pest] as to the scarcity of Shrimps covers all. Last season in the Brightlingsea district, where there are large numbers of smacks engaged in this industry, we started well and, strangely, those caught in the beginning of the season were large mature ones, contrary to the usual catches, when we have small first. . . . We have had this season a scarcity

unequalled in the memory of the oldest men. . . . Now comes a strange feature: Have you ever known two seasons in succession where so few females are carrying eggs? . . . I have no doubt the enormous number of small Whitings, and, worse still, Whiting Pouts [Bibs], have had a great effect. With regard to Whiting Pout (*Gadus luscus*), they have abounded to an extent never before known here. They have come up the Colne into shallow brackish water, and I think they have been the greatest cannibals as regards Shrimps."

Inspector Donnison in his 'Report' characterized the catch of Brown Shrimps (*Crangon vulgaris*) as a failure: "At Harwich the season was the worst on record." The Inspector says: "At Lowestoft and Yarmouth the men were at sea day after day, and got practically nothing." The same applied to the Wash fishery. His opinion was that the enormous numbers of Whitings, and to a less extent small Codlings, which for months "infested" the inshore grounds, were mainly responsible.

When chatting with some shrimper friends on this subject, they anathematized the hordes of young Whitings (that ran from three to four inches early in the season) "which ate up all the young Shrimps." One man in April, dredging from the Jetty to the Britannia Pier, off Yarmouth (less than half a mile), filled no less than two "maunds" (bushel-sized baskets) with these annoying, because useless, fish. When off Winterton early in June, he dropped his net and towed it for fifty yards; on hauling it in he found a mere handful of Common Shrimps, and *two pecks* of Whitings, five inches in length!

The men have altogether been hard hit, for when conditions were becoming somewhat more favourable and visitors (their best customers) were beginning to troop into the town, the devil of pride and avarice entered into the Kaiser, and war broke out, an immediate stampede depleted the lodging-houses, and the "season" came to an abrupt end.

On January 23rd I was discussing some Periwinkles, when I discovered one with a white pearly line following the whorls of the shell round and round.

By the merest accident I observed, on January 26th, on a fish-slab upon a heap of others, what I, at the moment, thought was a Flounder. A second glance assured me that the fish, its

under side uppermost, was slightly different in shape. On reversing it I found the thick or dorsal half was very much in appearance and texture like the Flounder; the "lower" half was freckled and decorated with the small knob-like processes seen on the Turbot. The ventral spine of the Flounder parent was present, but proportionately thicker and shorter. It contained roe. Length 17 inches; width 9½ inches; weight 2½ lb. I purchased the fish, and had it fried for my dinner, finding the flesh firm, and more like the Plaice in flavour. The big "breeches" (sexual organs) I could not decide to be either roe or milt, until having fried them, the globules of ova came out distinctly enough under a lens.

January 28th.—Saw an example of the Lemon Sole (*Solea lascaris*) "paired" with a Common Sole, on sale on a fish-slab.

PLAICE NOTES.—On January 30th I saw several Plaice, all of the same size, and it is more than probable they were of the same brood, with patches of the olive green upon the under surface. These were decorated by red spots corresponding with those in size and position on the upper surface. I have before noticed that when a Plaice has been taken exhibiting blotches below, there are almost invariably others turning up of a similar peculiarity and of exactly the self-same size. A left-handed Plaice was shown me by a fishmonger, who was at the moment cleaning a number of the species. He noticed it immediately he started to behead it for filleting. He had to turn the fish about.

February 2nd.—A fine Ballan Wrass, the colour of a Tench, was placed in my hands. There was some considerable excitement created at Corton in April over the advent of another Ballan Wrass, eight inches long. The village correspondent sent a glowing account of it to the local paper, in which he describes its "gorgeous colouring, green, gold, and blue running riot over an olive green ground. It was exhibited to all and sundry, but even fishermen of experience could not name it, never having met its like before." It was finally booked as a Gilthead, but my young friend, Mr. F. C. Cook, biked over from Lowestoft, and was fortunate in seeing it before it was destroyed. He immediately identified it as *Labrus maculatus*. I have not

the slightest doubt that this species turns up as frequently off the Suffolk coast as it does off Norfolk.

I never remember seeing such quantities of small, undersized sea fishes—"refuse" from the trawl-nets—hawked round the town on barrows as obtained early in February: hundred-weights of small Plaice, the size of one's hand, and Skate no larger than tea-saucers. Such a waste of fish I suppose must necessarily follow the use of the trawl-net, but it is pitiful, nevertheless.

February 6th.—I notice that the Whitings which at Christmas time measured but $4\frac{1}{2}$ inches, and were taken very numerously on the lines of sea-anglers, now measure 6 inches. In October they had grown to 10 inches and over. Local waters teemed with this species in February, and Cods captured had their stomachs packed with Whitings.

A Codling of $2\frac{1}{2}$ lb. weight was landed by a Gorleston sea-angler, which was entirely minus a right pectoral fin, there being neither stump nor "swivel" present.

Pike were much in evidence at Oulton Broad, near Lowestoft, in January and February, a writer describing the water as "being alive" with them. Anglers made excellent catches.

The John Dory, early in the year, was numerously caught by Lowestoft trawlers off the North Norfolk coast. The average ran to about the size of tea-plates. I think them excellent eating: one needs but gut them and lay them in water in a frying-pan. When cooked it is an easy matter to scrape off the skin with a prong, and by a dexterous whip round the fins may be cleanly drawn out. With a little care the sides while firm and boneless may be removed from the backbone. A little piquant sauce immensely adds to the delicacy of the flesh.

It is rather remarkable that for all my many years' attempts to secure a local example of the Burbot (*Lota vulgaris*), I have been unable to do so. On February 10th Mr. W. H. Tuck, of Bury St. Edmunds, wrote me that in answer to a letter Mr. Howlett, of Newmarket, the well-known taxidermist, assured him that he could procure a specimen at any time. Thus wrote Mr. Howlett:—"I have frequently had these peculiar fish brought me. They are common in many of the dykes and tributaries of the Lark River. Only a fortnight since a 'dyker' brought me

two, not very large, about 2 lb. each. Horrible-looking fish, but the Fen natives tell me they are of a fine pink-coloured flesh, like a Salmon, and very good eating." The species seems fairly well distributed, and is mentioned in most local faunas, but it seems so elusive that it is referred to often with rather vague description. Lubbock ('Fauna of Norfolk') says: "I have known many caught; and some two and three pounds in weight." The last Norfolk example of which I have any record was taken in the 'seventies. Mr. J. R. B. Masefield, "North Staffordshire Freshwater Fish" (N. S. Field Club's 'Transactions'), remarks that "Col. Masefield has this fish in his ponds, where he says they do well, and he once caught one with a Minnow, 4 lb. in weight."

Dr. Day ('British Fishes') refers to a general belief that the species is dying out and "doomed to extinction"; this would seem to me to fairly well apply to it in Norfolk rivers. I hope I am wrong.

February 27th.—Thousands of sprat-sized Whitings are being captured in the shrimp-nets. They are a nuisance both to the shrimper and to the sea-angler, one of whom hooked about two hundred in two days.

Pike on the Norfolk Broads had been fairly well on the feed at the end of February and beginning of March. Among other catches of this "freshwater Shark" may be mentioned one by a London angler, who secured three fishes in one day, weighing respectively 21 lb., 14 lb., and 9 lb. In two Pike captured were found Bream; one fish having in its stomach two Bream, each weighing 1½ lb. At this particular time they seem to have been freely taken on the Beccles River (Waveney), and at Oulton Broad, near Lowestoft. One at Wroxham was captured which weighed 22 lb., length 3 ft. 5½ in., girth 1 ft. 11½ in.

A largish Lumpsucker (*Cyclopterus lumpus*) was taken in a shrimp-net early in March. The fish was dropped into a puddle of salt-water at Gorleston, where it created some degree of interest among onlookers. Although fairly common, especially in the spring, its pumpkin-shaped body and rough skin always excite the curiosity of a crowd and the fisher-folk themselves.

Small Whitings swarming on Breydon. On March 11th a shrimper, dredging up the channel there, secured half a bushel.

He had also captured several small Bass of some half-pound weight each.

May 4th.—A 3-inch Black Sea-Bream (*Cantharus lineatus*) was brought me by a shrimper. A few faint dusky lines were visible on either side. This species is rare in this locality. None of the Sea-Breams are in any repute for food in this neighbourhood, and none are ever sent here with the trawl fish.

Mr. Thos. C. Rising, of Lowestoft, wrote me on April 21st to the effect that some fishermen draw-netting at Corton (half-way between Yarmouth and Lowestoft) captured some dozen Bass running up to 10 lb. in weight. "In view of the comparatively large numbers of small Bass taken here by anglers during the past season, one might almost wonder if this sportive fish is likely to take up a residence in our neighbourhood."

May 12th.—A very nice example of the Boar-Fish (*Capros aper*) was sent me which had been captured in the neighbourhood of the Wash.

Found an exceedingly large female Three-spined Stickleback (*Gasterosteus aculeatus* var. *semi-armatus*) lying dead in a ditch near my houseboat. The water is always more or less salty, as the tidal water filters through the sluice, and the dense vegetation must make swimming a matter of some difficulty. To account for this fish's death, I can but make conjecture that it could not find a mate and nest and the excitement necessary to a complete and due disposal of its ova. I have occasionally found other females dead packed with mature eggs.

On May 10th when "opening" a bloater for grilling I noticed the Herring's stomach somewhat unduly distended: on emptying it into a tube of spirits, and shaking it gently, the contents dissolved themselves into a number of small crustaceans—*Hyperia*, probably *Lestrigonus exulans* (Kröyer), the dark heads seeming all eyes. A few minute *Gammarus*, somewhat digested, were also to be distinguished.

May 27th.—Scribbled Mackerel (*Scomber scriptus*), a 12-inch example, came to hand to-day. Fish of this variety (?), several of which I have seen, never exceed and seldom attain a length of 15 inches. It contained a fairly well-developed

roe: the stomach was empty. When cooked I found the fish dry and insipid. In the stomach of a Common Mackerel I found, on the 28th, about a dozen Lesser Sandlaunces.

In the 'Fishing News' of June 13th an interesting account is given of a Mackerel glut, when vast shoals filled Dovercourt Bay in the extreme south of Suffolk. It is reported that boatmen by just dipping their nets overboard caught large quantities. Many of the inhabitants had quite an exciting experience in dragging ashore nets packed with fishes; even young urchins fishing with rod and line secured numbers, some getting over a score. Persons who waded into the water landed numerous fish. It was supposed at the time, and no doubt correctly, that Whitebait swarming in the shallow inshore waters were the attraction, and that Porpoises unwittingly "played a part." Undoubtedly these cetaceans were having a really good time among the Mackerel.

During the month of June the Suffolk ditch connected with the Waveney, in which my houseboat is moored, was swarming on the neap tides with Roach, running to half-pounders. They came to a shallow corner near a sluice-gate to bask in the sun and to feed on the flannel weed (*Conferva rivularis*). I could persuade but a very few even to look at my fat gentles: one or two which I dissected had their stomachs distended with the weed, and their intestines were loaded outside with an accumulation of fat. They, when horizontally poised, appeared keenly alive to what happened in front of or above them, and would dash with extreme celerity at any insect floating upon the surface. They moved about like so many sheep, and often fed in a shoal head downwards; the upper lobe of the tail, waving easily, kept them in position. The drainage water from the farm and slightly higher part of the marsh was dirty, and probably abounding in *Infusoria*. Many were exuding digested weed. One I captured had a host of black spots under the scales, a common occurrence, due to the presence of parasitic *Sporozoa*: fish feeding in unclean waters seem very susceptible to it.

Some large prices were realized at Lowestoft in August, shortly after the outbreak of the war. On one occasion a Ramsgate smack landed a catch at the fish market. "Roker"

(Thornback Ray) fetched £2 a trunk; small "Roker" made 30s. The weight per trunk would be roughly about eight or nine stone. A previous "record" was in August, 1909, when I saw a picked trunk of this fish sell at 30s. This happened after a long spell of calm weather, when the sailing-boats could not fish. A trunk of Soles on that occasion went as high as £13: on the present "Slips" (small Soles) made £12 a trunk; and I should think that the sum of 15s. for 14 lb. of Plaice had never before been exceeded.

Angling on the Broads this summer was not up to the average, although occasionally fish came on to feed and afforded some sport. At Hickling Bream (*Abramis brama*) bit well in the middle of August; one angler taking 6½ stone in a few hours. A gentleman fishing in that neighbourhood for a week had a good time with the Perch, catching fish weighing respectively 2½ lb., 2 lb. 1 oz., 1 lb. 10 oz., 1 lb. 8 oz., and 1 lb. 4 oz. It is a great pity that local prejudice condemns all the hundredweights taken yearly to the refuse-heap.

Several Scads, or Horse Mackerel (*Caranx trachurus*), were captured by sea-anglers both at Yarmouth and Lowestoft during the month of August. Plenty are netted among the Herring and Mackerel, but they seldom come to feed in shallow waters, and as a rule are rarely hooked.

A rather unusual show of Sapphirine Gurnards (*Trigla hirundo*) at the latter part of August. They had been taken in waters comparatively close by, as fishing trawlers have been frequenting restricted areas, owing to the unholy sowing of mines in the North Sea by the Germans. The Sapphirine Gurnard is mostly on sale in May, when fine examples are seen on the fish-slabs.

WHITINGS.—Sea-anglers commenced fishing for Whitings early in September, when these fish, which proved exceedingly abundant, ran to 10 inches and 12 inches in length. The piers were well crowded with eager fisher-folk, and many fished from the beach, where at night the seashore was lined with lanterns, which marked each piscator's location. I collected a few current figures from the "number board" attached to one—the Britannia Pier—covering the best part of three separate weeks: the numbers are as follow:—

Sept. 19th	...	76 Whitings	10 Dabs	12 Codlings
„ 20th	...	175 „	9 „	56 „
„ 21st	...	313 „	9 „	94 „
„ 22nd	...	299 „	12 „	31 „
„ 23rd	...	218 „	14 „	28 „
„ 24th	...	334 „	17 „	5 „
„ 25th	...	417 „	35 „	4 „
„ 26th	...	603 „	24 „	2 „
„ 27th	...	1435 „	25 „	1 „
„ 28th	...	1687 „	19 „	7 „

These captures were varied by an occasional Dog-fish, Edible Crab (one up to 4 lb.), Coal-fish, and a number of Grey Gurnards. One may imagine that numbers of Whitings must be swarming off the East Coast, when similar results characterized the various piers dotting the East Anglian seaboard. Even better results reward boatmen anchored some little way out to sea. On occasion the shoals are "spotty"; now and again they bite daintily, and are far from easily hooked, at other times they rush at any bait—lugworm and mussels, not refusing even half-putrid Herring. Sometimes they are on the feed all day, whilst at other times they absolutely refuse all bait until dusk has set in; while it is notorious that they bite as well, or even better than on the flood-tide. A long continuance of fine weather and placid tides is followed by a falling off in numbers, when a "stir-up" of wind and water would seem necessary to bring in fresh shoals. After a stiffish north-westerly wind Codlings appear, and come on to feed in exciting numbers:—

Oct. 7th	...	1895 Whitings	64 Dabs	7 Codlings
„ 8th	...	1079 „	22 „	4 „
„ 9th	...	1174 „	20 „	2 „
„ 10th	...	1205 „	28 „	2 „
„ 11th	...	2268 „	16 „	4 „
„ 12th	...	930 „	45 „	2 „

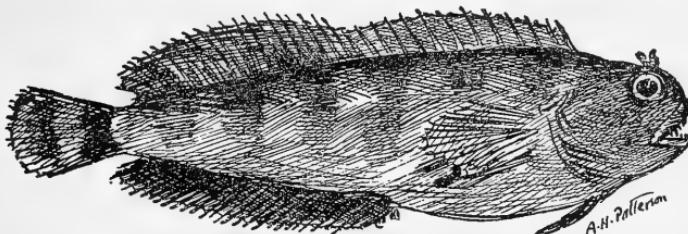
A few Whitings ran up to 2 lb. in weight, but the majority did not exceed $\frac{1}{2}$ lb. One boat fishing with two rods took, respectively, during five days' angling, 64 lb., 64 lb., 36 lb., 78 lb., 77 lb. At Lowestoft two sea-anglers with their boatmen captured 475 fish in one day; and on the second their catch was weighed

at ten stone. In October end and in the beginning of November the numbers fell off considerably. Soles up to 1 lb. 11 oz. in weight had also been caught on the hook.

On September 25th Mr. F. C. Cook informs me an example of the Short Sunfish (*Orthagoriscus mola*) was exhibited in a Lowestoft fish-shop: it had been captured off Lowestoft by a steam trawler. He did not measure it, but suggested that from the tip of the pectoral to the tip of the anal fin it would measure 2 feet; judging by other examples of which I have records, the fish itself would be about 18 inches in length.

A Five-bearded Rockling (*Motella mustella*) was taken on a hook off Britannia Pier on October 14th. A by no means usual capture locally, although several are taken yearly in shrimp-nets.

My second Gattorugine (*Blennius gattorugine*) came to hand on October 26th, having been captured on a line by a young



BLENNIUS GATTORUGINE.

man fishing from one of the piers. This fish was a span long, and had turned to a dingy blackish-brown hue. My first example came to me from a shrimp-net on May 21st, 1899. The late Mr. T. Southwell recorded another taken on May 21st, 1900 (*vide* 'Victoria History of Norfolk,' p. 205). I am inclined to think that this last "record" arose from some confusion of dates in the notes supplied to the late Dr. Lowe, who was responsible for the account of the "Fishes."

There were a few goodly sized Roach taken in the Waveney near Beccles in late October. The 'Angler's News' records a catch of forty-seven Roach to one rod on a certain date, the largest of which weighed $1\frac{1}{2}$ lb.; five others scaled a pound each. On the following day a fish was caught by the same rod that weighed 1 lb. $15\frac{1}{4}$ oz. seven hours after capture.

It is rarely that the Coal-fish (*Gadus virens*) visits local waters nowadays, but two or three small ones had been hooked from the piers late in October and early in November. One brought to me to identify on November 6th weighed about $2\frac{1}{2}$ lb.

What undoubtedly would have been a record Herring fishing began this year under most inauspicious conditions, owing to the outbreak of war. Very early in the season the German mines flung broadcast with cold, calculating brutality did serious mischief among the boats, and restricted the fishing area, which became still more circumscribed when our own Admiralty was obliged to follow suit. Many of the boats with their crews were taken over by the authorities for mine-sweeping, so that numbers of the boats could not be fished. The Scotch boats putting in were exceedingly few; the Scotch fisher-girls came in very scanty numbers, as did fish-buyers, and all these left long before the normal ending of the season. Altogether some three hundred English boats and about seventy Scotch boats pursued the fishing. The loss to trade in many respects was enormous; "pickled" fish was forbidden exportation, owing to the possibilities of it being sent to Germany in a roundabout way. The lifelessness characterizing the whole fishing was depressing; quite half a hundred boats could not get crews.

Herrings this season were of good quality, and in general fetched good prices, in some instances realising record figures. The following examples of newspaper paragraphs (the 'Eastern Daily Press' issues one for Yarmouth and one for Lowestoft daily) may be taken as fairly typical reports, and should be interesting:—

"*Yarmouth, October 22nd.*—There was another busy day on the wharf yesterday, when something like one hundred and fifty boats arrived with from eighty crans [eight last] down, but the average was not quite so high as on Tuesday, and was estimated at thirty crans. Fresh Herrings sold steadily at 18s. 6d. to 15s.; and salted stuff, of which there was not much, made 15s. per cran. Another small party of Scotch girls arrived yesterday, and piles of filled barrels are now rising on the Denes, and in the curing yards."

"*Lowestoft, December 4th.*—The majority of the fifty boats arriving yesterday were only lightly fished whilst in many

instances the damage to nets was considerable. One boat landed forty-five crans of fresh, others only having a few crans, the price varying from 53s. to 60s. per cran. Overdays sold from 48s. to 50s., the highest catch being twelve crans. Over-night a local boat belonging to Mr. J. Breach arrived with a nice catch of one hundred and fifty crans which averaged 40s. a cran—a remunerative night's work."

"*Yarmouth, December 4th.*—Some twenty boats arrived yesterday, some of which had sixty crans, but the others had very small takes, and the quality was not so good as it has been. Fresh Herrings sold at 61s. 6d. to 57s. 6d. per cran. The continued rough weather with other circumstances is leading to more boats making up, and the end of the voyage is not likely to be very far off. The catch for the week to last Saturday was 5060 crans, making the total for the season 175,960 crans, as compared with 808,496 crans last year. This season our export of pickled Herrings has been practically nil. Last year at this time we had exported 576,407 barrels and 177,232 half-barrels."

Nothing of especial interest broke the dull monotony of the daily round, save on the rare occasions when Herrings were very scarce, then somewhat extraordinary prices were made. Several boats had made up to the beginning of November from £700 to £1000 for the fishing. A fishing voyage realising £700 to £800 was esteemed a good one for a sailing drifter—a type now extinct; whereas the voyage of a steam drifter, with its consumption of coals and greater working expenses, needs to obtain £1300 to £1400 to be characterised as a good one.*

On November 6th Herrings were at famine prices. One lot of 'longshores (a small, compact, highly-prized Herring netted by small boats near the shore), numbering eighty-eight fishes, sold for 8s. 6d. to a Yarmouth buyer.

In November stormy weather prevented the fleet going out. On Friday (13th) but two boats had come in up to three o'clock in the afternoon, and a third came in later. The first had about three crans, which made 90s. per cran; the last comer, with a twenty cran "shot," made 97s. per cran to one buyer. Late on

* The "top" English steam drifter the 'Girl Marjorie,' almost the last boat to pursue the Herrings, made for her voyage some £2700; a Berwick boat coming second with £2500.

the Saturday the 'Girl Marjorie' brought in forty-one and a half crans of fresh, and some salted, Herrings. The former realised 127s. per cran; a record price, not only for Yarmouth but for any other Herring port. The salted fish made 50s. per cran. On the following Monday a thirty cran catch sold for the same large figure as on the Saturday. In some seasons when a glut has occurred I have known a last (ten crans) of Herrings fetch but £2; and as low a figure as £1 10s. for "overdays."

The fishing had come to a dead stop by December 12th, many of the boats having already "made up." I have been fortunate in securing, in round numbers, the figures of this year's unfortunate "Harvest of the Sea."

Total crans: 177,430 (or 17,743 lasts) as against 824,213 (or 82,421 lasts) last year.

Boats fishing: English, 361; Scotch, &c., 72 (as against a total of 999 last year).

From the 'Eastern Daily Press' I learn that of pickled Herrings (fish packed in brine) 49,000 barrels have been shipped, "the chief portion going coastwise. Only three cargoes went abroad to Stavanger, Bruges and France, and these went just before or about the beginning of the war." Number of barrels shipped last year—820,527 barrels by two hundred and forty-four steamers. The report adds the following serious note:—"With a decline of 646,783 crans in the catch, and a falling off of exports by 780,527 barrels, it is probable, taking into account all subsidiary elements—salt, coal, barrels, labour, losses on lodgings, port dues, and so forth—the monetary decline in one way and another compared with last year amounts to a million sterling, on quite a modest estimate." Add to this the failure of the summer lodging season—Yarmouth has indeed been hard hit by the war.

Of Cetaceans I have seen none whatever brought in, nor Sharks; and only on one occasion saw any number of Piked Dogs (*Acanthias vulgaris*) washed up at the tide-mark. Very few dead Herrings or Mackerel have at any time been cast up at the tide-mark, and the vast hordes of Gulls that collect in the vicinity of the harbour have been sadly put to for food; the poor creatures might have been seen sitting disconsolately on the shore or flying hungrily after each other in a mad scramble

for any coveted prize. The smaller Gulls that did not go inland or to some more tempting localities haunted the sewer outlets by the quaysides, glad to snatch at floating pieces of bread, or the skins and fragments of Herrings that drifted in the foul waters. The gutting yards were invaded, when the work-folk had gone to meals, for any pieces that might be found lying around. The nets spread on the south denes (sand-dunes) to dry were diligently examined by the hungry birds in their search for fragments and heads still entangled in the meshes. Later on the hungry birds became so emboldened as to resort to the fish wharf, on the roof of which they swarmed, to the entertainment of the wharf-folk, who threw on the slates broken Herrings and Whitings: for these the birds scrambled pugnaciously, but a fish once seized upon was seldom lost by the first to claim it. Salt Mackerel were as eagerly pounced upon, and as quickly devoured. A fish merchant complained to me of a catch of Herrings being badly mauled by Gannets as the fish hung in the nets before hauling. This is the first time I have ever had complaint made to me with regard to this species being troublesome; many Gannets visit the fishing ground, but hitherto have always been described to me as "fishing fair," *i.e.* naturally.

Mr. J. H. Gurney ('Irish Naturalist,' October, 1914) defends the Gannet against "alleged destructiveness" to the Herring. I myself have long been convinced that so great is the fecundity of the Herring that it is impossible for sea-birds—Gannets, Cormorants, and others—ever to reduce, let alone deplete, the shoals that annually throng our coasts: the great reduction in numbers of Cetaceans, large and small, in recent years must also be taken into account, as well as the present increasing capture of Dog-fishes for food. Nothing, I am convinced, can ever exhaust the Herring shoals, save the destructive trawl-net, which in a few hours is capable of destroying a hundred million times as many Herrings (*in the ova*—seeing that this sinks to the bottom) as all the sea-birds in Christendom devour, in the adult form, in a twelvemonth.

November 18th.—Observed a $2\frac{1}{2}$ lb. Eel brought from sea, which was of an intensely dark blue-black colour all over, without the slightest suggestion of silveriness anywhere about it.

The earlier part of the fishing for Sprats off the Suffolk

coast was by no means encouraging: Mr. E. R. Cooper, of Southwold, writing me on November 19th, stated that "none were landed here worth talking about until last week, when about five hundred bushels were landed at the harbour, about one-fourth of the total catch."* The restrictions placed upon the fishing did not allow the usual freedom to fishermen: the Admiralty's order may be of more than ordinary interest as showing the dangers incidental in war time even to shallow water fisherfolk:—"Board [Board of Agriculture and Fisheries] are informed by Admiralty that Sprat fishing is permitted this winter on condition that boats do not go either to the westward or to the southward of the Mouse or use the Barrow Deep. Please inform the fishermen."

I never saw finer Sprats than have been exported for sale this winter, or with less "muck," *i.e.* weeds, crustaceans, *e.g.* *Idotea*, *Gammarus*, &c., nor had I fallen in with its peculiar parasite *Lerneonema sprattæ*.

On December 8th Mr. E. R. Cooper again wrote me as follows:—"Spratting is going on very well here; the total landings for Southwold in November were over four thousand bushels. On Sunday last (6th) one thousand six hundred and forty bushels were landed here; yesterday about one thousand five hundred bushels. To-day the boats were coming in well fished but too much wind to start again. [Sprats fish best on still foggy nights.] The bay is alive with Sprats, which we attribute to the southerly winds. The first fish train ran from the new harbour branch on Sunday with eleven tons of Sprats, and yesterday seventeen tons went from there a 21½ lb. Cod has been taken from the Pleasure Pier, which is a record for Southwold."

On December 9th all the fish shops had their quantum of Sprats on sale; in some cases owing to the dearth of trawl-fish they were the only fishes to be seen on the fish-slabs.

From a report sent to the 'Angler's News' of December 12th by Mr. S. W. Reynolds, forty-four tons of Sprats were sent to London on December 6th, and thirty-four tons on the following day.

* Many of the boats land their catches on the beach, hence the varying tonnages mentioned on December 6th and 7th.

Mr. F. C. Cook writes me on December 8th that "a Cod was exhibited in a fish shop window on November 4th that had been blown up by the explosion of a mine, and landed quite on the deck of a fishing boat ; a piece of the mine was also shown with it." There can be no doubt that many fish have been killed by mines, but as these victims almost invariably sink, they at once offer food to other species and to the crustaceans that feed upon carrion. I recorded the washing up of a lean disreputable Cod which had undoubtedly been a victim to a submarine explosion : wreckage had at the time been blown up by the Trinity House authorities (*vide 'Zoologist,' December, 1911*).

Inspector Donnison in his most interesting half-yearly Reports on the Eastern Sea Fisheries called attention, in March, to the abundant catches of Smelts in the Witham, both by anglers and fisherfolk, which our Aldeburgh fishermen, who are always up in arms against the Terns, would do well to notice. These men should surely know the difference between the Smelt and the "whitebait" (juvenile Herrings). His remarks and statistics given of the Mussel and Cockle industries make very entertaining and profitable reading. The Yarmouth Mussel—that in my younger days, before the rivers and Breydon were so hopelessly polluted by sewage, gave employment at a dull season to quite a score of humble folk who dredged for the mollusc—is now entirely prohibited as food, and only an occasional fisherman takes it to sell as bait.

The Inspector complains of the presence of so many Dog-fish (*Acanthias vulgaris*), whose attacks on Mackerel caught in the nets often spoil one fish in five. He advocates a greater consumption of the "dog," giving as a proof of its increasing popularity the weight landed in England and Wales as 31,262 cwt. in 1911, and 55,539 cwt. in 1912, mostly taken off the south and south-east coasts. The species is, I find, commonly seen on Lowestoft fish market, but local prejudice is nearly as strong as ever in Yarmouth, where it is seldom put up for sale, and is then only covertly purchased by fish fryers. Mr. Donnison mentions an instance when, crossing from the Norfolk to the Lincolnshire coast he "watched the crew of a French trawler getting in their net, and it was so full of Dog-fish that it was only by instalments that the catch was boarded."

Other interesting items worth noting are as follow:—“According to the estimate given by the local Fishery Officers, 979,000 Crabs and 38,100 Lobsters were landed in the district this year to date” (Report for half-year to September 30th). Most of these were taken off Norfolk. Oysters—English and American—did well at Hunstanton. No less than 102,000 cwt. of Cockles were landed at King’s Lynn for the twelve months ended August 31st last. He also writes: “Some of the Flemish Refugees, for whom homes have been found on the Norfolk coast, at once took to Mussels as a part of the food-supply to which they were accustomed in Belgium.”

Only one jarring note finds a place in the Report, a wail from the Blakeney fishermen who, I think unjustly, accuse the increasing, well-protected Terns on Blakeney Point of seriously damaging the Smelt and Shrimp fishery. Unfortunately this class of men, like African witch doctors, *must* make some accusation against something, when natural causes, which they do not allow their intelligence to rightly fathom, make against their usual success. To the falling off among the Shrimps and Prawns I have already alluded.

On one or two occasions late in November a large shoal of Codlings up to 7 lb. and 9 lb. in weight afforded our few long-liners a little remunerative sport, while the numbers of Whitings had almost entirely vanished. I was interested in the frequent stunted Cods captured, and saw four on as many days, the head being disproportionately large for the size of the body, as shown in Yarrell’s drawing (‘British Fishes,’ vol. i., p. 533).

The most curious Crab claw met with came to hand on April 3rd. In a small edible Crab I found the right pincer claw had been recently injured, a healing process having covered the fracture (no doubt, temporarily) with a shelly process: the left pincer claw never possessed but one chela—the upper free one—and even this was slightly distorted in shape, although it worked freely enough. The under fixed chela had never been present, so that the Crab had been quite incapable of nipping or tearing its prey, and I was not surprised at the starved and emaciated condition of the hapless crustacean.

A Bib (*Gadus luscus*) captured off the Suffolk coast early in December was found to have its tail damaged by the parasite

Lernea branchialis. It is nothing uncommon, even in healthy members of the genus *Gadus*, to find fat *Lernea* attached to the gill-rakers, but I think the position referred to in the unfortunate Bib is very unusual. This species is far more numerous off the Suffolk coast than off the Norfolk coast; but early in December some rather unusual catches were made by long-liners off the north-east corner of Norfolk. Few fishes deteriorate in appearance in so short a time as the Bib, and it rapidly decomposes after death. Small examples are hardly worth the trouble of cooking; and the bones are much too obtrusive even in larger ones. The inflated eyes do not add to its attractiveness. Couch suggests that this bladder-like inflation is due to the terror of the fish when taken, "by the agony of which the air of the swimming bladder is driven into these membranous parts." Small Bibs taken in the shrimp nets, when thrown over at sorting time, float on the surface of the river, and drifting upstream to the Breydon are eagerly picked up by the Gulls.

I am again under obligation to my friend, Mr. Robert Beazor, senr., a well-known local fish merchant, for the following notes:—"Very little worthy of record has come to my notice. With regard to Smelts, draw-netting from the beach began this year as early as January 8th, when about four score came to the fish wharf. From the placing of the different catches on the market from time to time, I can form no other conclusion than that the fishing was not nearly so remunerative to those engaged in it as in former years. The largest quantity on any one day was between fifty and sixty score. With regard to trawl fish I have little to report: catches were meagre and prices ruled high. The few 'Wolders' [small trawlers fishing the Wold] fishing made fair catches when able to go out, but frequent gales curtailed their efforts. What Soles (their principal catch) they caught made very high prices.

"The Mackerel and midsummer Herring voyages were practically failures. No great quantities were landed; I think the latter was due greatly to the capture of Herrings in the spring, when occasionally large quantities are taken, but are of little value as food and only fetch remunerative prices when wanted by long-liners for bait.

"I have had brought to my notice several times this autumn, Herrings (when cut for kippers) containing both the male and female organs (milt and roe), the sexuals varying in size. I have seen hermaphroditic Mackerel.

"Lately (December) I have seen numbers of Bibs sent from Cromer in boxes; fine fish, locally called 'Whiting-pouts.' They were large, of fine quality, very similar in eating to the Haddock, but with the Whiting flavour. As regards our autumn Herring fishery, this terrible war has sadly marred it. Hundreds of men who manned the boats were requisitioned by the Admiralty.

"Three or four Anchovies were brought to me at different times, having been captured with the Herrings."

It may be interesting to add that towards the close of the year trawl-fish had, in this neighbourhood, lessened practically to vanishing point, and but for the remarkably good Sprat season the majority of our fish shops might have closed their doors, unless smoke-dried fish (*e.g.* "Bloater" and "red" Herrings) formed a part of the stocks: several small shops had on sale nothing else but Sprats, a heap of fresh ones in the centre, with "Bloater," Sprats, and "red" Sprats on "spits" (sticks) making a tempting display around it.

With regard to Mr. Beazor's remarks on the Smelt; I believe that, generally speaking, Breydon and the adjacent rivers were well fished, but several of the smelters send their catches in small boxes direct to Billingsgate Market. But prices have ruled rather low.

NOTES ON ANEMONES FROM THE MILLPORT
MARINE BIOLOGICAL STATION.

By RICHARD ELMHIRST, F.L.S.

It is well known that "increase by spontaneous fission," is an occasional means of reproduction in Anemones (*vide* Gosse, 'History of British Sea-Anemones,' 1860, p. xxi.). In a paper, "Regeneration and Non-sexual Reproduction in *Sagartia davisi*" (Univ. of California Publications; Zoology, vol. i., 1904), H. B. Torrey and J. R. Mery describe the details of fission, and give a useful bibliography of the subject. From many recorded cases it appears that dividing individuals usually complete their division in a few days or weeks; this is especially the case in *Anthea*. On the other hand, however, I have seen cases of "double" *Actinolobas*, which showed no change during a period of several months; it may be, of course, that when "double" specimens are brought into captivity some change in their environment may arrest the normal course of their division.

ACTINIA.

In 1911 I found an *A. equina* with two complete discs, mouths, and sets of tentacles. After nearly four years in captivity there is no change in the form of this individual. In January, 1913, I found a second *A. equina*, with two almost complete discs, &c., apparently in course of division. This specimen was isolated in captivity. In March and April it produced a few normal young; by May all trace of division had disappeared, and the specimen was apparently normal; for a few days an indentation across the base suggested that aboral-oral fission was about to take place. This did not happen, and the specimen is now (December, 1914) apparently normal. Normal young were extruded in the spring of 1914.

Five years ago I put a normal *A. equina* into a well-lit glass-

sided aquarium. It soon settled down, and in a few weeks both its colour and habits changed. It has grown considerably, and practically never closes but sits attached to the side of the tank or a stone, with the tentacles all hanging limply down and not spread in an erect manner, as is usual in *A. equina*. Each year it has produced a few young, all of the acquired olivaceous colour. They, too, have grown very large; I lately measured the base of one attached to the glass, and found it was $6\cdot4 \times 4$ cm. across. Their acquired colour, which suits the surroundings, is rather darker than that of *Ascophyllum nodosum* on the column, whilst the disc, tentacles, and young are about the shade of the yellowish green tips of *A. nodosum*. The edge of the disc and the "beads" are still of a pale blue colour. In August a young specimen, six months old, $1\cdot4 \times 2$ cm. across the base, began to divide, and completed its division in about three months.

URTICINA.

In February, 1913, I found a single specimen of *U. felina* in a most unusual situation. It was living in the middle of a sandy bay, with just the top of the column protruding; its base was swollen so as to anchor it firmly in the sand. There were no stones to which it could attach itself in the usual way.

STOMPHIA.

In July, 1910, in a tank containing several specimens of *Stomphia churchiae*, there were two specimens which had lived within a few inches to a foot of each other for about a year. When expanded, the smaller one was about 3 inches across the tentacles, and the larger about 6 inches. At 7.50 p.m. on July 4th I observed the smaller one sitting right in the mouth of the larger, both specimens being fully expanded. There was no sign of any struggle, as though the larger were trying to eat the smaller. The inner tentacles of the larger were adjacent to the outer tentacles of the smaller, were waved about, and from time to time touched those of the smaller. At 9.30 p.m. the smaller specimen, still expanded, began to emerge from the mouth of the larger, which curled back its tentacles on one side and protruded its gullet, and so helped the smaller to get away. When the

smaller was got rid of, the larger one closed quickly and completely, then promptly opened again. During the following days they were both again in their usual situations. Some time previously I had interrupted this process and freed the smaller from the larger, under the impression that the one was eating the other. The behaviour described above is peculiar, and I do not pretend to understand or explain the significance of it.

PEACHIA.

In "The Structure and Habits of *Peachia hastata* (Gosse)" (Proc. Royal Dublin Soc., N. S., vol. iv., 1885), A. C. Haddon and G. Y. Dixon give a good account from Holdsworth (Ann. N. H., 1859) of the way in which *P. hastata* buries itself. Observations made in 1914 entirely corroborate the account there given. With regard to feeding habits, they say: "This Anemone *can swallow** a good-sized piece of food if it is placed on its disc," such food is taken quickly, "and often without the aid of the tentacles at all. . . . The tentacles . . . do not seem to be provided with urticating powers to the same extent as the tentacles of other Anemones; for Shrimps and little fish that haunt flat sands brush against and even rest upon them, without suffering any apparent inconvenience." These remarks and a number of experiments and observations which I have made show that *Peachia* does not prey on other animals as the ordinary Anemones do. I supplied my Peachias with *Gammarus*, Plankton, and young fish a few days old, and found that the *Peachia* made no attempts to capture them. So I concluded that *Peachia* has some other way of procuring food. I then put powdered carmine into the water, and found that there was a steady ciliary incurrent stream through the conchula. After the carmine had been going in for a few minutes a carmine-laden mucus thread began to be extruded from the opposite (asulcar) side of the mouth. Diatoms were seen to be taken in in the same way as the carmine. Haddon and Dixon also say: "*Peachia hastata* . . . may often be seen with its tentacles withdrawn while the conchula is still protruded level with the top of its hole. . . . Sometimes when it projects perpendicularly out of the hole it

* The italics are mine.—R. E.

encircles itself with a collar about one inch in depth of slime set thickly with particles of sand."

Now, when in either of these positions, the *Peachia* can still feed by the ciliary incurrent stream, which can also serve for respiration. There is no ciliary current noticeable on the column, and only a very faint incurrent between the tentacles. It is interesting to note how similar is this ciliary mode of feeding to that of Cockles and other sand-dwelling animals. The part of the Southannan sands where we usually get *Peachia* is a place where Diatoms and small algae are often so abundant as to discolour the surface of the sand when the tide is out. The incurrent ceases when the *Peachia* is closed, and ceases for a while when partly closed after an alarm.

ON THE LOCATION OF THE SACCULUS AND ITS
CONTAINED OTOLITHS IN FISHES.

By COLONEL C. E. SHEPHERD (Indian Army).

In continuation of the article under the above heading that terminated in vol. xviii. (1914) p. 146, of the 'Zoologist,' fresh material has come to hand of interesting but not generally accessible fishes. The information gathered is now published to bring all the available knowledge on the subject up to date. Additional illustrations of otoliths, alluded to in the former paper, are also given.

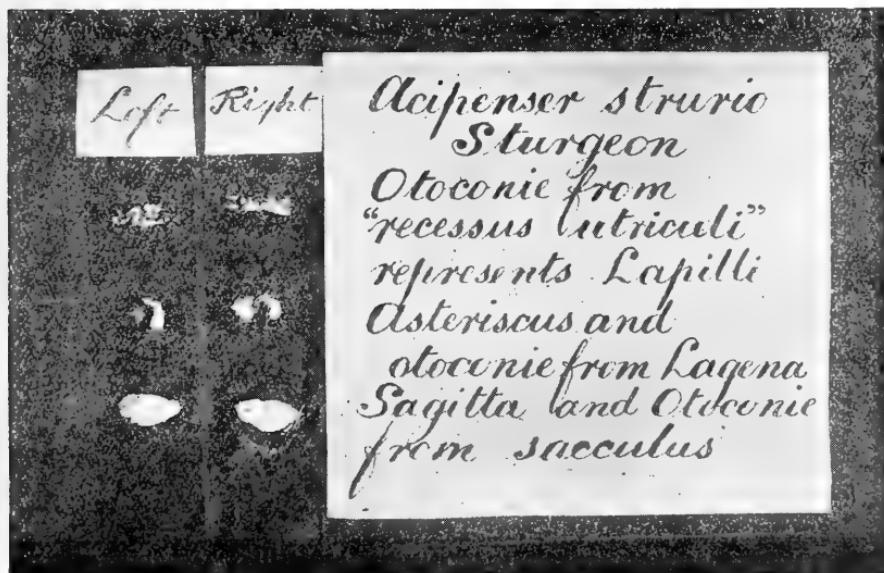


FIG. VII.

ACIPENSERIDÆ.

Acipenser strurio (the Sturgeon). Illustrated fig. VII. The otoconie in place of a solid lapillus, and in conjunction with the other stones seems to be a connecting-link, in the case of otoliths, between the cartilaginous and teleostean fishes.

ELOPIDÆ.

Elops saurus. The otoliths are illustrated (fig. IV., 9).

OSTEOGLOSSIDÆ.

Arapaima gigas, called the "Pirarucu" at Manáos, on the Amazon River, Brazil. To this species belongs the largest of freshwater fishes; it has a corresponding otolith (fig. V., 10). This is enclosed in a bony pocket that has to be cut open to obtain the otolith; there is no external indication showing site of sacculus. The specimen illustrated was got from a 5 ft. 9 in. fish caught in the interior of British Guiana. The rings of growth of the stone are to be seen in the upper one. The hump in the central part of the stone is a peculiarity special to this fish.

Osteoglossum bicirrhosum. The otoliths shown (fig. IV., 10).

CHIROCENTRIDÆ.

Chirocentrus dorab. Illustrated fig. V., 3.

OSTARIOPHYSI.

GYMNOTIDÆ.

Eigenmannia virescens. Illustrated fig. IV., 5.

SILURIDÆ.

Bagarius yarrellii (a freshwater Siluroid). This specimen came from one of the rivers in Bengal, India. It was over six feet in length; the otoliths are conspicuously small. There was no external indication either for the site of the sacculus or for the position of the lapilli. The swim-bladder which, in the Ostariophysi, is connected with the ear-labyrinth, is, in this fish in two separate small bladders. The Weberian ossicles which form the connecting-links were of good size, especially the "tripus." The contrast in size between the otoliths (fig. VI., 6) of *B. yarrellii*, and those of a salt-water Siluroid (*Ælurichthys gronovii*, fig. VI., 7) and of a *Gadus merlangus* (fig. VI., 8) is instructive.

Ælurichthys gronovii, one of the so-called "Catfishes," got at Demerara, British Guiana. This is allied to the Arius family, and the specimen obtained was a moderate-sized fish, probably some eighteen inches in length, judging by the head, which was the only portion sent. The site of the lapilli, the biggest of the otoliths, was shown externally by two big swellings of thin, shiny

bone, and that of the sacculi was indicated by two slight swellings. The lapilli were picked out of their respective cavities without any cutting away of bone, but to get the sacculi and their contents the bone had to be carefully cut away.

Piratinga sp.?, a river Siluroid from British Guiana, where it is called the "Lau Lau." It grows to a great size, even up to seven feet. The site of the lapilli was shown by two bulges in the bone of the skull; the site of the sacculi was likewise indicated

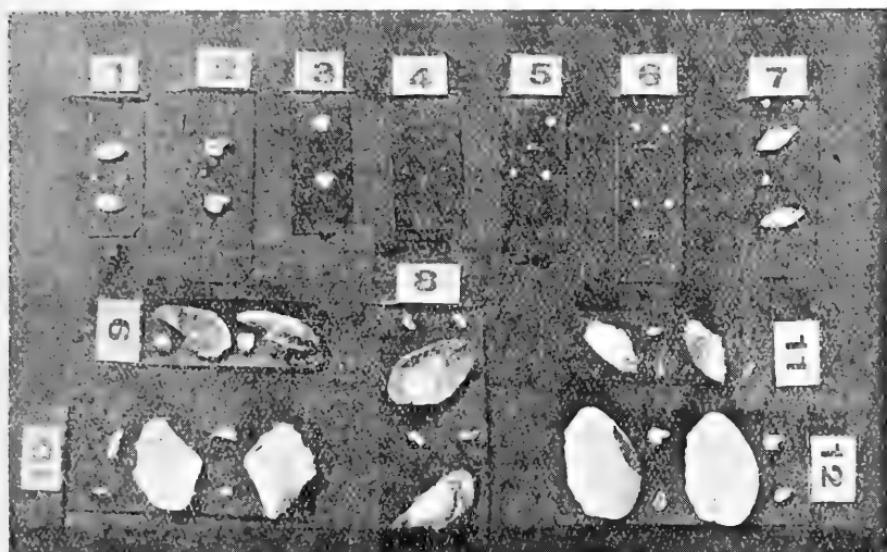


FIG. IV.

1. *KUHLIA MARGINATA*.
2. *TREMATOMUS HANSONII*.
3. *BREGMACEROS MACCLELLANDII*.
4. *AMPHISILE SCUTATA*.
5. *EIGENMANNIA VIRESSENS*.
6. *ASPREDO SICUEPHORUS*.
7. *NANDUS MARMORATUS*.
8. *LUTJANUS ANNULARIS*.
9. *ELOPS SAURUS*.
10. *OSTEOGLOSSUM BICIRRHOSUM*.
11. *ATHERINICHTHYS ARGENTINENSE*.
12. *MURÆNESOX TALABON*.

externally by slight prominences. The otoliths themselves were small for the size of the fish.

Doras maculatus, a freshwater Siluroid, called the "Bombom" at Demerara. There were no external indications of sites of otoliths. The lapilli are very small for the size of the fish. Neither of the sagittæ were found.

ASPREDINIDÆ.

Aspredo sicuephorus. Illustrated fig. IV., 6.

SYMBRANCHIDÆ.

AMPHIPNOIDÆ.

Amphipnous cuchia, an Indian fish that has accessory breathing apparatus enabling it to live out of water, buried in mud, or to live comfortably out of the water in the weeds on the banks of a river or pool. The site of the sacculi is indicated by a shiny flat surface on the bone of the occiput. The sacculi do not lie exactly under the skull but rather to the outer sides. There is a distinct lagena. The sagittæ, though embedded in bone at the sides and ends, could be lifted out through the orifices above them.

APODES.

Muraenesox talabon, called "Koolarie" by the Tamil fishermen of Madras. The sacculi of this fish are pointed out in their position by two large excrescences of the basi-occiput. The sacculus is much embedded in bone, the sagitta fills the pocket it is contained in fairly tightly. The lagena is small but distinct, attached to the extremity of the sacculus. The sagitta is large and flat. Fig. IV., 12.

PERCOPSIDÆ.

Percopsis guttatus, a freshwater fish found in North America. The sites of the sacculi are shown by two large oval bulbs on the basi-occiput of very thin bone. The sagittæ are large for the size of the fish. Fig. VI., 5. The specimen obtained was but three and a half inches long. No trace of asterisci could be found.

FISTULARIIDÆ.

Fistularia serrata, a fish from India. There are two elongated swellings of thin bone on the basi-occiput, not immediately underneath but rather to each outer side that point out the position of the sacculi. The sagitta is small.

AMPHISILIDÆ.

Amphisile scutata. Illustrated fig. IV., 4. There is a slight notch in the sagitta that is only visible if magnified.

ATHERINIDÆ.

Atherinichthys argentinense. Illustrated fig. IV., 11.

MUGILIDÆ.

Mugil brasiliensis. Illustrated fig. V., 6.

OPHIOCEPHALIDÆ.

Ophiocephalus marulius, the "Mûrrûl" of India, an esteemed freshwater table fish. This fish has an accessory breathing apparatus, enabling it to use atmospheric air in respiration. It often passes a considerable time under the mud of dried-up tanks. The sites of the sacci are shown by two prominent bony excrescences of the basi-occiput that project into the cavity occupied by the accessory breathing apparatus: the bone of the excrescences is not transparent. The sacci are in pockets with

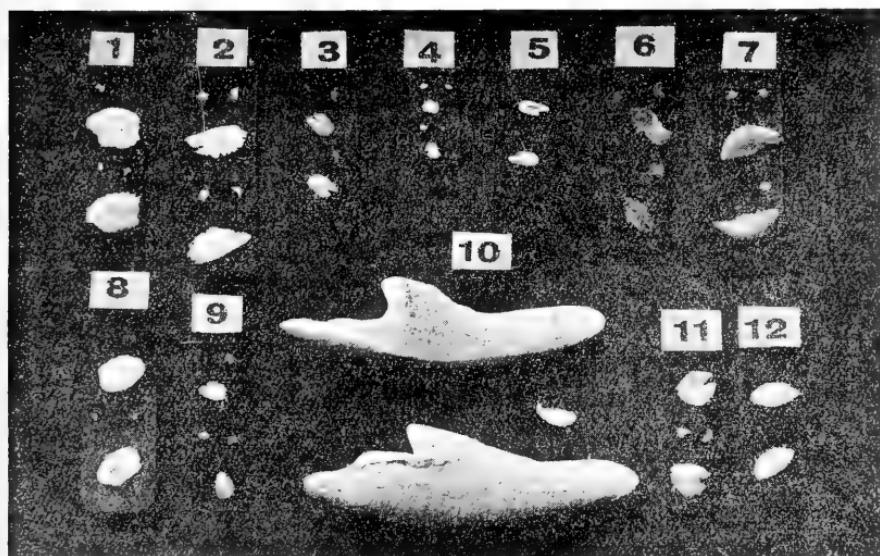


FIG. V.

1. <i>PSETTA LOEVIS.</i>	2. <i>PERCA FLUVIATILIS.</i>	3. <i>CHIROCENTRUS DORAB.</i>
4. <i>CAPROS APER.</i>	5. <i>CLUPEA HARENGUS.</i>	6. <i>MUGIL BRAZILIENSIS.</i>
7. <i>SILLAGO SIHAMA.</i>	8. <i>HIPPOGLOSSOIDES LIMANDOIDES.</i>	
9. <i>MULLUS BARBATUS.</i>	10. <i>ARAPAIMA GIGAS.</i>	11. <i>TRIGLA GURNARDUS.</i>
		12. <i>URANOSCOPUS SCABER.</i>

open tops through which the sagittæ could be got out. The lagenæ, a broad prolongation of the sacculus, is embedded in bone and has a pocket of its own that required careful cutting open to obtain the asteriscus. The right lapillus could not be found in this fish, although both were got out of another specimen. The "sulcus acousticus" is well-defined (fig. VI., 1.)

MACRURIDÆ.

Macrurus investigatoris, a deep-sea fish from the Indian Ocean at a depth of 446 fathoms (2676 ft.). A prominent bulbous swelling of thin bone under the skull, and sufficiently transparent, allows the sagittæ to be seen "in situ." The sagittæ could be picked out of their pocket through the opening at the top of it; they are large for the size of the fish (fig. VI., 3).

Macrurus armatus has a similar bulbous excrescence to that above described that contain the sacculi.

Bathygadus furvescens, a deep-sea fish from the Indian Ocean at 555 fathoms (3330 ft.). A bulb of transparent bone under the basi-occiput allows the sagittæ to be seen; they are fairly large for the size of the fish (fig. VI., 4). They fill the cavity in which they rest, giving no room for motion, and were got out easily without much cutting away of bone. A distinct lagena with a special pocket for it.

GADIDÆ.

Bregmaceros macclellandii, from the Bay of Bengal, Indian Ocean. Günther says of it, "a dwarf Gadoid, the only one found at the surface between the Tropics." As in other Gadoids the sagittæ are large for the size of the fish (fig. IV., 3). The specimen obtained was only two and a half inches in length.

Gadus merlangus (the Whiting). Illustrated fig. VI., 8.

BERYCIDÆ.

Hoplostethus mediterraneus, a deep-sea fish from the Indian Ocean, got at 330 fathoms (1980 ft.). A large transparent bulbous swelling under the basi-occiput allows the sagittæ to be clearly seen. When the head was inverted and rocked from side to side the sagittæ, the right-side one especially, could be seen moving in the sacculus and falling from side to side, showing the roominess of the cavity containing them. The sagitta is large and of uncommon shape, with its two little projecting spikes (fig. VI., 2). The "sulcus acousticus" runs in a boldly curved line along the length of the stone and curves upwards at the forward end. The sacculus has a distinct lagena to it.

CENTRARCHIDÆ.

Kuhlia marginata. Illustrated fig. IV., 1.

TOXOTIDÆ.

Toxotes jaculator, an Indian fish, with the curious habit of shooting its prey of flies, as they sit on leaves of plants over-hanging water, with a pellet formed of a drop of water. They are kept in aquaria by the natives of Bengal to watch the process. A swelling of thin bone, but not of great size, denotes the site of the sacculi. The sagittæ were lifted out easily without any cutting away of bone. They are large for the size of the fish (fig. VI., 11).

NANDIDÆ.

Nandus marmoratus, an Indian fish. The specimen examined came from the delta of the Ganges. Two very prominent bony excrescences on the right and left of the basi-occiput indicate the sites of the sacculi; the bone is hard and not transparent. The lagena is a distinct broad prolongation of the sacculus. The sagittæ are moderately large; the pocket that contains them, although open at the top, requires the bone to be cut away before they could be abstracted (fig. IV., 7).

PERCIDÆ.

Perca fluviatilis ("the Perch"). Illustrated fig. V., 2.

SERRANIDÆ.

Lutjanus annularis, a fish from the Indian Ocean. A piece of thin bone but not transparent projecting slightly from the basi-occiput points out the site of the sacculus. The sagittæ are very much curved (fig. IV., 8), and are fairly large, also much embedded in bone that requires to be cut away to get them out. The lagena is a broad prolongation of the sacculus, but not marked off by any appreciable constriction.

SILLAGINIDÆ.

Sillago sihama, called "the Whiting" by English people at Madras because it is a good table fish, reminding them of Whiting. The sites of the sacculi very plainly marked by two prominent swellings on the basi-occiput of thin bone, transparent enough to show the sagittæ in their natural position, which is very much inclined to the centre line of the skull. The sagittæ are much curved (fig. V., 7), and the bone at the two ends requires to be cut away to get them out. The lagena is a

distinct prolongation but not marked by any constriction of the sacculus. The "sulcus acousticus" not very well defined.

SPARIDÆ.

Chrysophrys berda, from the Indian Ocean. A piece of thin bone on the basi-occiput, but not standing out from it, shows the site of the sacculi; neither is the bone thin enough to be transparent. The sagitta is much curved, also much embedded in bone. A distinct lagena marked, by a constriction, from the forward part of the sacculus.

MULLIDÆ.

Mullus barbatus (the "Red Mullet"). Illustrated fig. V., 9.

CAPROIDÆ.

Capros aper (the "Boar Fish"). Illustrated fig. V., 4.

OSPHROMENIDÆ.

Osphromenus hepturus, a fish from Java. The same remarks apply as in the case of *O. olfax* described in the 'Zoologist,' April, 1914, p. 139.

CICHLIDÆ.

Tilapia hendcloti, from the Mabole river, Sierra Leone district, West Africa. The location of the sacculi shown by two prominent excrescences, one on each side of the basi-occiput. The pocket enclosing the sacculus is open at the top but required cutting away at the two ends. The lagena end especially required releasing. The lagena shows as a distinct prolongation marked by a slight constriction where it takes off from the sacculus.

Hemichromis bimaculatus. This specimen came from the Mabole river; it is also found in the Nile. The sites of the sacculi shown by two prominences of thin bone, one on each side of the basi-occiput. The sagittæ are large for the size of the fish.

PLEURONECTIDÆ.

Psetta loevis (the Brill). Illustrated fig. V., 1.

Hippoglossoides limandoides (the Long Rough Dab). The position of the sacculi shown by two small bulbs on the basi-occiput, the sagittæ are rather inclined to be large for the size of the fish; they show the rings of half-yearly growth very distinctly when they are first got out of the head (fig. V., 8).

KURTIDÆ.

Kurtus indicus, a small fish from the Indian Ocean. The specimen obtained was got on the Orissa coast, Bay of Bengal. Two prominences, but coalesced so as to appear like one large bulbous swelling of thin bone under the basi-occiput, show the sites of the sacculi most apparently. A distinct lagena. The otoliths are all large for the size of the fish (fig. VI., 9).

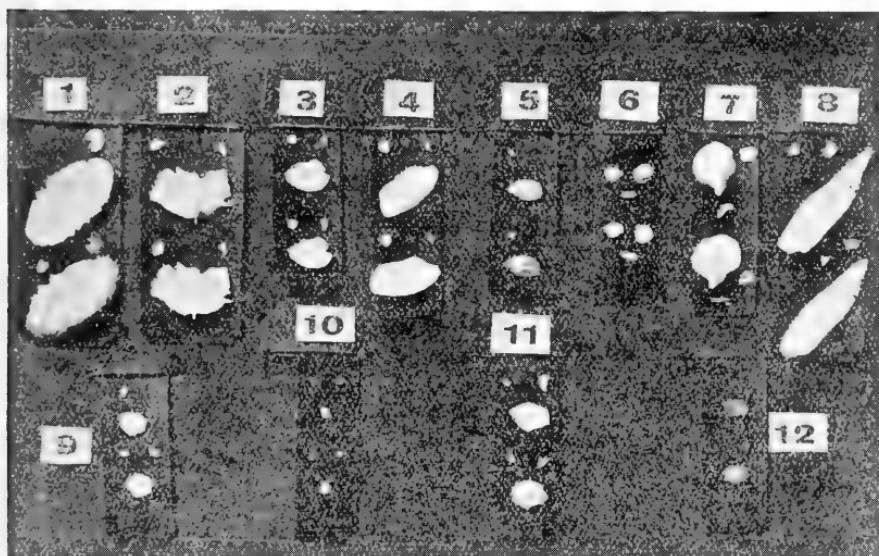


FIG. VI.

1. *Ophiocephalus marulius*. 2. *Hoplostethus mediterraneus*.
 3. *Macrurus investigatoris*. 4. *Bathygadus furvescens*. 5. *Percopsis guttatus*. 6. *Bagarius yarrellii*. 7. *Ælurichthys gronovii*. 8. *Gadus merlangus*. 9. *Kurtus indicus*. 10. *Ostracion gibbosus*. 11. *Toxotes jaculator*. 12. *Amphipnous cuchia*.

TRIGLIDÆ.

Trigla gurnardus. Illustrated fig. V., 11. The deep notch in the sagittæ of the family shows distinctly.

NOTOTHENIIDÆ.

Trematomus hansonii. Illustrated fig. IV., 2.

URANOSCOPIDÆ.

Uranoscopus scaber. Illustrated fig. V., 12.

OSTRACIONTIDÆ.

Ostracion gibbosus. The fishes of this family are all called "coffer" or "trunk" fishes, owing to the rigid box-like case they are enclosed in. The specimen examined came from India. There is no external evidence to show the sites of the sacculi. The ear-labyrinth each side is contained and reposes in two cavities inside the skull, whence it was picked out by forceps without any cutting. The sagitta and asteriscus in one, and the lapillus inside the "recessus utriculi" in the other cavity (fig. VI., 10).

Ostracion nasus. The observations made for this specimen are similar to those for the previous one.

NOTES AND QUERIES.

AVES.

Birds Travelling North in Autumn.—Referring to Mr. Gurney's notes on this subject (Zool., 1914, p. 449), I might state that on October 2nd I witnessed a northward movement of Mistle-Thrushes in fair numbers; a few flocks of Linnets were also going in the same direction. I was away from the coast for several days after October 2nd, consequently I have no notes for the 7th, when Mr. Gurney observed the northward movement. It has been my practice for several years to watch the seasonal migrations at Lowestoft, and I have often been puzzled at the cross-movements, both in spring and autumn, more especially during the earlier part of the seasons. It is quite usual to see Linnets, Pipits, Tree-Sparrows, &c., going south in early spring, and the same going north in autumn. I have occasionally seen Rooks, Jackdaws, and Hooded Crows arrive from over the sea in autumn, and fly north on reaching land, and have wondered whether the movements of Finches may have been of a similar character, the birds having arrived on our shores further south.—F. C. COOK (Lowestoft).

Nesting of *Troglodytes parvulus*.—Referring to Mr. E. P. Butterfield's note ('Zoologist,' 1914, p. 432) on the nesting of the Wren (*Troglodytes parvulus*), he may be interested to know that I recorded several similar instances in the 'Zoologist,' 1910, p. 158. In June, 1913, another case occurred in my garden, where a Wren built a nest inside a box roughly formed of cork bark, intended for Tits, placed against the bole of a tree. Here, again, very little nesting material was visible outside except round the orifice, which was reduced in size. The top of the box in this case was lined with moss inside, as elsewhere, forming a dome but of course not showing outside. This summer a pair built a nest of the normal type, worked into the side of a Thrushes' nest, somewhat high up in an apple-tree, and both were occupied at the same time.—S. G. CUMMINGS (9, King Street, Chester).

Pied Blackbird at Yarmouth.—On December 5th a very beautiful Pied Blackbird was shot at Upton, near Acre, a few miles from here. The bird had been observed for some months in the neighbourhood, but up till then had successfully evaded its pursuers. It was fully adult, and, I believe, a male bird; its "markings" on either wing were as evenly distributed as those of a Snow-Bunting; the tail, however, was not so evenly blotched with white. A feather or two on the right side were mostly white, three others being tipped only, whilst the left tail-feathers were black. I was fortunate in obtaining the bird for my blind friend Dye's small but choice collection of locally obtained birds. — A. H. PATTERSON (Ibis House, Great Yarmouth).

Display of female *Eunetta falcata*.—On that particularly miserable wet morning (in London, at any rate), January 3rd, I found several species of Ducks vigorously displaying at the Zoological Gardens, including the fine Falcated or Bronze-capped Duck (*Eunetta falcata*), of Eastern Asia, which has only been imported freely during the last year or two. The display of the males was essentially similar to that of the most typical ducks—Mallard, Pintail, Gadwall, Teal, &c.—though the erection of the full long crest made the head look enormous in size. There was the same rear-up with head bent down, followed by an up-jerk of the hind parts; the long sickle-shaped tertials, so noticeable in this species, seemed little if at all expanded, and were not so prominent in the display as one would have expected from their abnormal character. But what especially attracted my attention, as I had noted the display of the male of this Duck some time before, was that the females displayed simultaneously with the males, and with the same gestures. This is commonly seen with the Muscovy Duck (*Cairina moschata*), but I have never noted it in the case of female Mallard, Teal, or any other species of the typical group to which *falcata* undoubtedly belongs, its nearest ally being perhaps the Gadwall. Female Mallard have their own ways of communicating their emotions, but not, so far as I know, by gestures resembling those of the drakes.—F. FINN.

Bark-peeling Habit of Sparrow.—At the back of my lodgings there are several small lime-trees, the branches and twigs of which are much attacked in places by the local Sparrows, which peck away the outer bark and drag off bits of the inner fibrous layer, no doubt to line their nests, as they carry it off by the beak-full; one may see branches thus stripped for at least a yard of their length, and they were doing this even last month.—F. FINN.

NOTICES OF NEW BOOKS.

Text-book of Embryology. Vol. i. Invertebrata. By E. W. MACBRIDE, M.A., D.Sc., F.R.S. Edited by WALTER HEAPE, M.A., F.R.S. London: Macmillan & Co. 1914.

THIS monumental work, of course, specially appeals to the expert laboratory zoologist, the subject demanding for the most part special training and acquaintance with the technique of section-making, &c. This technique is fully dealt with in the course of the work, and directions are also given for the rearing of various free-swimming embryos, which in some cases has been remarkably successful; a suitable food for some of these minute marine organisms has, it seems, been discovered in the diatom *Nitschia*, which has been successfully submitted to artificial cultivation.

Naturally most of the work is not of a character to appeal in this way to the biononical as well as the morphological zoologist; but it is worth noting that Professor MacBride's style is admirably lucid and avoids technicality even in a highly technical subject. He speaks, for instance, of certain ova as "yolky," where the average morphologist would have yielded to the temptation of saying "polylecithal." In matters where difference of opinion exists he always puts his arguments temperately; and in fact the book is a model of exposition.

Certain types in each natural group are selected for description in development, preference being given to those which are accessible to students in temperate regions, and to those which have been most recently worked out. The *Echinodermata*, on which so much important embryological work has been done, naturally bulk largely in the work, and some of the results of the experimental embryology practised on the ova of the animals of this phylum are of extraordinary interest. Hybrids, for instance, have been produced freely between the sea-urchins *Echinus esculentus* and *E. miliaris*, and the hybrids thus obtained,

which have been reared through their metamorphosis, vary remarkably in their inheritance of parental characters, even from year to year. But far more remarkable than this is the fact that different orders of Echinoidea can be crossed, whereas in Vertebrates and Insects even separate families cannot be thus treated. Professor MacBride has himself bred larvæ from *Echinus esculentus* and *Echinocardium cordatum*, though they could not be kept alive longer than eight days. Most wonderful of all is the fact that echinoderm eggs can be fertilized by mollusc sperm and yield larvæ.

It is found, moreover, that echinoderm eggs can be fertilized by simply being treated with hypertonic sea-water, *i. e.* water in which the normal proportion of chlorides is increased; but the segmentation in such cases is occasional and irregular, and the larvæ feeble, lying on the bottom.

Professor MacBride has much of interest to say on the subject of larvæ more familiar to the ordinary naturalists. He considers that the worm or grub type of larvæ is really an ancestral form, modified by the necessities of its environment, and points out that the active larva of the Cockroach is not really ancestral, but passes through a stage in the egg in which it shows rudiments of abdominal limbs, recalling a worm-shaped ancestor like a centipede. Abdominal limbs also occur in *Machilis*, one of the most primitive insect order *Thysanura* (the Spring-tails). He points out that the most helpless and worm-like larvæ, those of the more specialized Diptera, are practically in the position of parasites, and have lost their limbs and even their jaws in consequence. The parallel might have been carried farther; for larvæ of the caterpillar and maggot type exhibit the peculiarity, noticeable in parasites, of being able to live entirely on one kind of food, and preferentially doing so, while many fly-maggots are actually parasitic in various ways, from merely sucking the blood of the host to actually living inside it. Altogether this book is one to be most warmly recommended to all naturalists.

EDITORIAL NOTES.

Miss R. S. TWYMAN writes from Leominster: "I am very sorry to have to tell you that my Swift [see 'Zoologist,' 1914, p. 152] died about two months after you were here. [This was on a lecturing engagement terminating in March, 1914.] It continued to thrive and to take its food right up to the end. It died in a fit, brought on, I am afraid, as the result of fright. A few minutes before it was clinging in its usual place, on the front of my dress, under my chin. My sister, who is Secretary of the Women's Adult School here, brought in two of the members who had expressed a wish to see the Swift; they were strangers, and the bird had of course not heard their voices before. I noticed it was more than usually nervous, but being anxious to encourage the interest taken in the bird, I continued to show them all its habits, and placed it in its basket, that they might see how it spent the night, when it almost immediately had the fit. I think it would not have happened if I had kept it on my hand or my dress. It was a great disappointment to lose it. The plumage was much healthier after the moult.

"I have generally been successful in rearing young birds. About nine years ago I found a whole nest of Sparrows on the ground; they had been dragged from the nest by the parent bird, by one of those untidy ends which Sparrows are so fond of leaving hanging from their nests. This nest was in the point of a gable in a house three stories high. They all lived, and when fully fledged I found homes for them. I gave one to my sister, which is still alive, and a most interesting companion. It has always been allowed to fly about the room for a part of every day; the door or window can be left open—it will not attempt to fly away. One of its legs was injured in the fall, but it has lived its life very cheerfully, hopping about on one leg. Another one was injured on the side of its head, and no feathers developed on that part. It is wonderful what a Sparrow will survive.

"I have also reared Starlings which have fallen from the nest at a few days old—one lived for five years. I found them the most companionable birds I have kept. I clipped one wing and they were let out in the garden for the greater part of the day; they would

come to me when I called to them, and if I sat out in the garden would spend the time either on my chair or near my feet on the ground—when I came in they would retire to a hedge or into a tree."

THE docility of the Starling in captivity is well known, though it is very rarely kept as a pet now-a-days; but Miss Twyman's success in keeping a picked-up Swift nestling for nearly a year, and moulting it successfully, is a most remarkable avicultural achievement. Her notes on the pet Sparrow are also of particular interest, because it has been suggested that Lesbia's Sparrow, honoured with a funeral notice by no less a person than the poet Catullus, could not have been a Sparrow, because Sparrows make such unpleasant cage birds.

It is true that the Roman Sparrow must have been *Passer italiae*, which replaces *domesticus* in Italy, and may well differ in disposition from it; the large and beautiful Russian and Siberian Goldfinches, though not now separated as a species from our Goldfinch, are well known to be much quieter in captivity, and are commonly exhibited soon after importation. But, in addition to this record of Miss Twyman's, there are two other recent ones of common House-Sparrows kept as pets by English ladies, and proving most interesting birds—one given by Mr. W. H. Hudson in his 'Birds of London,' and one published in that very interesting collection, Dr. W. T. Greene's 'Notes on Cage Birds.' Thus there is no reason to doubt that the Roman lady's pet was a true *Passer*. With regard to the bird cited by Mr. Hudson, it is of interest to note that it lived to the age of eighteen years, dying at last suddenly and in good condition.

'THE VERTEBRATE FAUNA OF NORTH WALES.'—Mr. H. E. Forrest writes: "I am preparing a Supplement to the above volume, and shall be glad to receive any additional notes or observations from naturalists who can help in that way. Address: H. E. Forrest, Bayston Hill, Shrewsbury." No doubt many readers of the 'Zoologist' will be able to give the required assistance, but we might perhaps be allowed to suggest that such notes might well be sent to this magazine; there has been a regrettable shortage in the "Notes and Queries" of late, while the publication of the notes would be of service to compilers of books, inasmuch as one observation, published, is likely to draw a record of another.

ERRATA.—Vol. xviii., December, p. 452, *Asplachna* should be *Asplanchna*.

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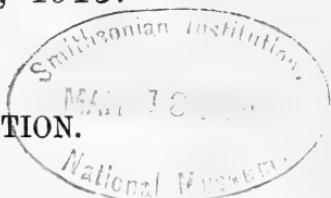
No. 884.—February 15th, 1915.

THE SENSE OF DIRECTION.

By J. M. DEWAR, M.D.

THE "sense of direction" is a term used to denote the unknown means which enables birds and other animals to return to the localities they have left. The phrase also applies, though with less propriety, to the mechanism by means of which migratory animals proceed to regions they do not know, whether these regions have been occupied by the animals' progenitors or not. In the observations herein recorded the sense of direction is considered from the aspect of the animals' environment. The environment plays a part in the formation of the guiding mechanism by providing data which may be used by the organism in finding its way from one place to another. As it happens, the immediate problem of a directive sense really turns on the nature and extent of the external factors employed. At the same time, the value of the possible factors can only be determined when due regard is paid to the kinds of sensory organs possessed by the animals, and also to the probable degree of efficiency which the sensory organs concerned and the associated nervous processes attain.

Regarding the nature of the directive mechanism two historic theories may be said to hold the field. The one, strange to say, has been supported mainly by workers with insects, and is briefly a "memory of localities," or a "knowledge of landmarks"; the other has been applied conspicuously to the higher animals, and is a capacity to sense the position of the objective in terms of



the bodily displacements in space experienced on the outward journey.

An extensive literature has accumulated around these two theories. Among birds, most of the experimental work has been performed on Carrier Pigeons. The results, too numerous to be detailed here, show that the experimenters, for the most part, prefer the theory of a knowledge of landmarks. In this view they are in general agreement with most of the workers on insects. On the other hand, some of the most distinguished students of avian migration have maintained the inadequacy of the theory to account for the long oversea journeys of migrating birds. And, it may be remarked, a sufficient number of trials has been recorded to show that Carrier Pigeons are able to return home across the open sea, that is, without the help of a knowledge of landmarks. The second theory also presents difficulties under conditions in which the objective, or a landmark on the way to that point, is visible from the beginning of the flight, and it is not a complete explanation of the mechanism of long oversea journeys.

It is convenient at this stage to propose a division of the phenomena of homing flight into three classes on a negative basis produced by the various considerations which have just been resumed. By the allocation of a given flight to a particular class, the subsequent search for the directive factors will be facilitated. The divisions are as follows:—

Class 1. In which at the time of departure visual perception of the objective cannot be excluded.

Class 2. In which visual perception of the objective may be regarded as impossible, and in which the guiding influence of land dispositions cannot be excluded.

Class 3. In which there is no visible means of guidance of any kind.

Instances assignable to each class will occur to everyone. The first and second classes invite the very evident explanatory theory of a memory of localities. For the amazing flights performed by birds, and coming within the third class, this theory is obviously invalid.

The directive mechanism readily admits of analysis into two component parts. The first component is the means which

primarily determines the direction of flight, and it may be regarded as static in operation. The second component is the means by which a true course is kept, and it is dynamic in mode of operation. While it fulfils the conditions of the first component, the theory based on a sense of displacements does not adequately comprise those of the second. For, if a persistent wind blows across the track of birds travelling a long way over open water, then the birds are faced with the difficulty of neutralizing drift, as Darwin pointed out.* Should the travellers have no perception of a strong leeward drift from their true course, then at any given part of the journey the birds will not point towards their destination, but along a line which is parallel to the original course projected from the point of departure. Such a misfortune might readily be attributed to birds far beyond sight of land. Nevertheless, it is advisable to believe that birds possess the power to correct deviation in the absence of landfalls.

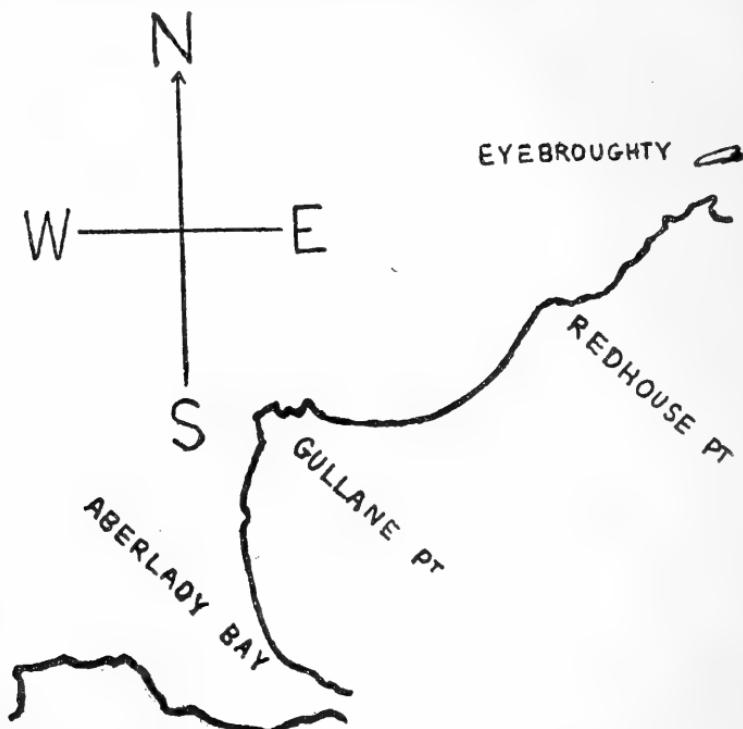
The observations which I am about to record tend to show that the theory of a sense of displacements accounts for the first component of the sense of direction more satisfactorily than the theory of a memory of localities; that a memory of localities is not employed under conditions in which one would expect a useful knowledge of landmarks to be demonstrated; and that the former theory does not sustain the keeping of a true course.

Obs. 1.—Fog. Visibility range 1500 yards. Wind N.W., 1. Twelve Geese from inland on course N. by E. magn., made the sea at Redhouse Point, East Lothian, and turned W.N.W. After going so far on this course, the three leaders turned about S.W.; the rest continued W.N.W. for some time, and then followed the leaders. They were thereafter watched going S.W. along the coast of Gullane Bay as long as they were visible. The Geese invariably rest in Aberlady Bay after having been inland. The direct line from Redhouse Point to Gullane Point was afterwards found to be W.S.W. magn.

Obs. 2.—Fog. Visibility range 300 yards. Calm. Observation made from "sill" opposite Eyebroughty Brig, Firth of Forth. The usual flight of waders, during high water of spring

* Darwin, "Posthumous Essay on Instinct," 1859. Appendix to 'Mental Evolution in Animals (Romanes),' p. 357.

tides, from Aberlady Bay to Eyebroughty, takes place on a straight course from Gullane Point to the west end of Eyebroughty. To-day Oystercatchers only were observed. They were heard repeating the "pik" call for some time before they were seen, and the sounds came along the mainland coast which



SKETCH-MAP OF THE COAST. Scale: one knot to the inch.

the birds proved to be following. They passed the "sill" and were going further eastward, when their calls were answered by a single clear trill coming from a bird of the stock resident on Eyebroughty. The flock turned immediately and abruptly, and flew in silence in the direction of the sound, their safe arrival being indicated by a fog-subdued whistling coming from the same region.

On the return journey, when the visibility range had risen to about a thousand yards, the birds left Eyebroughty in successive bands which approached the mainland westward of the "sill," and turned right-handedly to coast instead of following

their usual practice of flying directly to Gullane Point. (Eyebroughty is nearly 400 yards distant from the nearest point of the mainland.)

According to the state of the weather these observations range themselves in one or other of two of the three classes of migratory movements. In a clear atmosphere they belong to the first, and in foggy weather to the second class. Certain considerations will, I think, make this clear. The Geese and the Oystercatchers were travelling, in the one instance daily, in the other frequently, towards objectives which were ordinarily visible from the beginning of flight. When the weather is clear the Geese are remarkably constant in their line of flight to and from the inland feeding grounds, regularly following a course which lies nearly parallel and close to the long axis of the Bay, and it is noteworthy that they then neutralise drift unless the wind is exceptionally strong. In fog with a light westerly breeze they fail to make up leeway in returning to the Bay, and strike the coast, it may be, a mile or more eastward, when they redirect themselves towards the Bay. It does not appear that the usual height at which the Geese fly makes the ground below invisible to them when the range of human vision is not less than that of the second observation. The uniform failure to make up leeway in a number of observations suggests, though it does not prove, that the Geese habitually orient themselves by direct sight of the Bay, and have no cause to pay heed to the landmarks in passing. The evidence, however, is not so strong as it might be, as there is always the possibility that in some considerable portion of the flight the land was hidden from the birds by the fog.

The Oystercatchers furnish more valuable evidence on this matter. The basaltic sill opposite to Eyebroughty is a conspicuous and distinctive feature of the landscape. It is also unequivocally the shore landmark for the Brig, and the birds are often enough on the Brig to become familiar with the landmark if they wished or were able. Yet the birds actually passed the sill, and their course was changed in a fraction of a second after the trill was uttered. It is clear that the actual course of events depended on the trill, and not on recognition of the basaltic rock. Had the calls not been answered by a trill

from a bird on Eyebroughty, the flock would have gone out to sea. It is, therefore, probable that in the flights to Eyebroughty the landmarks passed on the way are not recognised.

The second result of the observations approaches the problem of the second component. The Oystercatchers did not venture to follow the direct "oversea" route from Aberlady Bay, as they always do in clear weather. The fog would have hidden them from the land for the whole of the journey—a distance of nearly three miles—and they would have been compelled to direct themselves with sufficient accuracy to strike a rock which has a breadth of only fifty yards. Instead they followed the coastline, there is every reason to believe. It is true they were known to do so only as long as their calls were audible. But previous fragmentary observations made at several points further west render it probable that in fog the birds hug the coast the whole way. When the return journey was begun the birds turned westward correctly, and without hesitation on striking the coast of the mainland. They knew that Aberlady Bay lay to the west. But their means of keeping a true course was not sufficiently adjusted to enable them to proceed in fog on the direct course over the sea. The observations on the Geese tend to confirm this conclusion. On reaching the shore the Geese changed their direction of flight to the westward, and showed a general knowledge of the position of Aberlady Bay. On the assumption that the new direction of flight was correctly observed, there was, however, a difference of 45° between the magnetic course taken by the Geese and the magnetic bearing of Aberlady Bay.

From these observations we may grant the birds had at least a constant knowledge of the general whereabouts of the place or places to which they were impelled to go. A knowledge of landmarks was not acquired, though such were available on many occasions. The means of correcting drift was not adequate in fog. On the other hand, the observations throw no light on the use or disregard of the objective as a guide when that is possible. Nor do they clear up the nature of the mechanism of the first and second components. On these matters further information is required.

A Canary which had the liberty of a room was in the habit

of flying many times a day from one end of the room to the door of its cage. When the cage was removed a distance of a few feet to one side, I found that the Canary flew to the exact spot where the door had been.* It is thus apparent that the Canary had a knowledge of the position of the cage door in space, and that it did not need to look for the entrance in order to fly accurately towards it from a distant point. Visual perception of the objective, as a means of guidance, was therefore not used by the Canary in making habitual flights.

Topham and others, especially Bethe, arrived at a similar result with Bees, the latter emphasising the idea of a locality in space as the virtual nature of the destination, a remarkable circumstance long since recognised, for Thompson records that Bees "know their hive more from its locality than from its appearance." Watson made analogous experiments on Terns, and with like results.† He was able to show that the environment, the egg, and the nest itself, could be eliminated, or completely altered, without affecting the capacity to return to the immediate locality of the nest, and it is this—the locality of the nest—that Prof. Watson regards as the principal factor in homeward orientation. From the results of his experiments Prof. Watson suggests that "if adjustment (*i.e.* to the nest) is made in terms of visual data, the visual environment which serves as the stimulus must be complex and have a wide extension." But he is not prepared to admit that adjustment takes place in terms of vision alone. These experiments are particularly valuable in that they were made on birds whose European representatives, according to Slonaker, are capable of binocular vision.‡ My own observations apply to birds which have only one area for clear vision in each eye, and which apparently do not have binocular vision. Thus, in spite of the capacity to see clearly ahead, the Terns were not aware of any

* The experiment was repeated almost daily, and often unintentionally for several years on the same bird, and on a second Canary for a shorter period. No material variation in the result was observed.

† Topham, 'Nature,' April, 1874, p. 484; Bethe, *Pflüger's Archiv.* Bd. lxx. s. 72, 1898; Thompson, 'Passions of Animals,' p. 53, 1851; Watson, 'Carnegie Institution, Washington,' *Publ.* No. 103, p. 227, 1908.

‡ 'Journal of Morphology,' vol. xiii. p. 445, 1897.

changes in the locality of the nest until after they arrived, while in those birds without binocular vision a clear perception of the objective can only be obtained by turning the head to one side.

Direct vision of the objective is not required by certain diving birds, which are able to fly distances of from one-half to two miles over the sea to feeding areas of small extent and lying two to five fathoms under muddy water. The absence of landway after the first dive forms a test of the accuracy of the orientation, which, indeed, rarely errs by more than a few yards.

It is thus possible to exclude the use of an immediate visual perception of the objective and a knowledge of landmarks, even though these are available, when it is clearly recognised that habitual flights of longer or shorter duration can proceed towards a successful conclusion without the aid of either of these methods of orientation. And therewith we exclude the whole environment from the mechanism of the first component of the directive sense. The advantage so far gained lies in the circumstance that, whether the flights extend over a few yards or several hundreds of miles, the mechanism of the first component is reduced to one kind only—is the same for all habitual flights.

The data on which the first component rests must then be internal and independent of the environment. To account for the nature of the internal data, Bonnier put forward the theory which is based on the sense of displacements.* Bonnier asserted that there is no known instance of an animal making a definite movement to a certain place where it had never been, and, so far as I am aware, the assertion is still true to-day. All movements made by animals with the object of reaching definite localities are return movements. Further, the capacity to return to the original point of departure does not extend over unlimited distances. The limitation suggests a mechanism dependent on a knowledge of places, and it has, indeed, been so interpreted. But the objections to this view are too weighty to be overcome. From the two facts just cited it is apparent that the mechanism of the first component is dependent on impressions acquired on the outward journey, and that these impressions are internal and not due to the environment is maintained by the

* Compt. Rend. Soc. Biol. t. iv, p. 1051, 1897.

proven ability of animals to return safely home though they are carried in closed receptacles on the outward journey, through a country they cannot possibly know. Bonnier, with regard to human orientation, considered that a knowledge and memory of all the series of displacements, since the point of departure was left, are sufficient to keep us constantly in touch with this point, or we may exert ourselves, perhaps unconsciously, to maintain always the notion of its direction in the course of our displacement, but without preserving a memory of our successive displacements. So many instances are known of animals returning by a different route from that along which they set out, or were carried, that a memory of the successive displacements may be dismissed as unnecessary. The alternative proposed by Bonnier is more in keeping with the facts as they are known to occur in animals. As each displacement occurs and is sensed, the bearing of the point of departure is readjusted in terms of the extent and direction of the displacement, but a memory of the displacement is not necessarily retained, and there is no subsequent readjustment in terms of memory. There may thus be a constant knowledge of the position of the point of departure, but there must evidently be a limit to the formation of associations on this basis, just as much as there is to the formation of associations on the basis of landmarks.

While Bonnier's theory is the most probable expression of the mechanism of the first component, the theory contributes nothing to the working of the second component. The superlative need of being able to keep a true course is indisputable. The ability is wonderfully developed in flying insects and birds, and it plays no inconsiderable part in successful orientation.

The Canary's cage stood in a window recess and was always clearly lighted for a considerable time after sunset, but the room was apt to grow rapidly dim. Observations extending over several years proved that the Canary had then considerable difficulty in returning to its cage, that it frequently failed to keep a true course, and that it circled the room repeatedly. This result speaks for visual impressions as a factor in the perfection of the second component of the sense of direction.

I have already quoted some observations to show that the

field of clearest vision in the flying bird lies in an antero-lateral relation to the bird rather than directly ahead. The bird has a simultaneous visual perception of objects lying on both sides of itself. Owing to the rapidity of its flight and a preoccupation with the object of flight, the bird does not form any definite notions as to the nature and position of neutral objects, but is concerned rather with wide surfaces and extensive lines occupying the visual fields. These surfaces and lines are used not to direct the course followed, but to preserve the straightness of the course originally projected from the starting point. Distances, then, rather than objects furnish the data for keeping a true course. And as birds fly with equal facility from all quarters towards their object, there can be no memory of the lateral distances at the successive points on the course projected. Hence the data are not geographical but mechanical. Continuous observation, it need not be consciously, of the surfaces and lines lying towards the limit of both lateral horizons furnishes a more delicate test of the straightness of the course that is being kept than binocular concentration on the objective lying directly ahead. The idea, it may be noted, is not purely speculative, for in some degree it can be given the trial of personal experience. The explanation just given accounts for the Canary's failure to reach the well-lighted cage when the room was dim, the more so as the lateral deviation, when it arose, occurred towards the really darker, or the farther away and therefore apparently darker, side of the room.

In more general relations it should be borne in mind that, though the flight of small birds is often ill-directed in semi-darkness, these birds, when they are migrating at night—as Gätke has pointed out—have no apparent difficulty in keeping their course.* Audition here is a possible factor of the second component; the more so as Prof. Watson found by observation at night that the erratic flight of individual Terns was corrected when their calls were answered from the nest.† At the same time, it cannot be said that visual data based on fixed lines and surfaces are essential to the mechanism of the second component, for none is present on the open sea. Gätke observed

* 'Heligoland as an Ornithological Observatory,' p. 63, 1895.

† *Loc. cit.* p. 217.

that migration was arrested when the sky was completely overcast, but it was resumed after less or more of starlit sky became visible. Possibly, we are here in touch with a visual factor of great importance, though of an unknown nature. It appears as if the sea, the sky, and the horizon, in whole or in part, furnish surfaces and lines of definite value, and as effective for the second component as the fixed surfaces and lines of the landscape. Most often in Nature the second component is disabled by the presence of haze or fog. Probably the absence of relatively fixed points in an atmosphere laden with condensing vapour makes the keeping of a true course impossible. If the bird continue its journey, drift may set in and pass unnoticed.

We have seen that the environment is able to furnish surfaces and lines for the maintenance of a true course. To a rapidly moving bird or insect these surfaces and lines must present the appearance of running contrary to the animal's direction of motion. Any divergence from the proper trajectory of flight alters the relative distances and the apparent direction of motion in the environment which must have the widest possible extension in order to prevent local peculiarities throwing the animal off its course. Now, if we suppose a bird in flight to be pointing towards its objective, and to be drifting before a wind blowing across its course, the definitive surfaces and lines coming within the visual fields will appear to run not directly but to curve obliquely backwards, the obliquity being inclined towards the wind. The oblique distortion of the environment and the peculiar alteration of the lateral distances relative to the bird will compel it by force of habit to correct the displacement. This the bird can only do by altering the axis of its body to an alignment lying between the direction of the wind and the course towards the objective. As it happens, birds actually do so whenever the cross-wind is of sufficient strength to set up drift. In general terms the deviation of the bird's axis, as estimated at the anterior end, is always towards the wind, whether it blows before or abaft the beam. Hence the bird has a constant tendency to eat into the wind a little, and the appearance of birds flying under these conditions suggests that the deviation to windward is proportional to the strength and direction of the wind, and automatically sufficient to

neutralise drift, provided the wing-power is adequate. The test for the last requirement can only be the environment in its widest extent.

The argument may be led against a second component based on visual impressions that the existence of an analytical mechanism under the first component, and dependent on an internal sense of displacements, renders the second component unnecessary. The contention is justified with regard to certain animals which, conditionally or otherwise, receive little or no external impressions. In these animals the first component is evidently very highly developed, and in itself is possibly adequate to compass the return home. But in birds and many insects the relatively great efficiency of the visual organs has, there are reasons to believe, militated against a gradual refinement of the sense of displacements to a grade of efficiency sufficient to control the course, which must be a "bee line" to be serviceable. As much is proved by the effect of fog and total darkness. These, as we have seen, destroy or disable the faculty of distant orientation. They do not, however, obliterate the knowledge of the position of the objective in space, for this knowledge remains intact. But the means of getting there is, for the time being, partially or completely lost.

Whenever the sense of direction for one reason or another fails, a return to the original point of departure is possible only by a visual re-orientation on that point of departure. As much is evident from some of Prof. Watson's experiments and from the Canary, which, after its cage was retained in a new position for some time, had to look for the door of the cage before it was able to return. Evidence as to the linear distance over which visual re-orientation can be accomplished is available, so far as I am aware, for Pigeons only. Hachet-Souplet left Pigeons at a certain place, and moved the cote to conspicuous positions at increasing distances from that place. When the separation amounted to more than ten or twelve kilometres, the Pigeons failed to return home.* It is thus evident that the appearance of the home, or original point of departure, is intimately associated with its position in space; and that, when the two are

* VI. Congrès Internat. de Psychologie, p. 663, 1910.

severed by more than a moderate distance, the knowledge possessed by the bird of the appearance of its home is not sufficiently accurate—or, at any rate, dominant—to overcome the confusion resulting from the disturbance of its position in space.

To summarize: the sense of direction is an expression of the means by which an animal is able to return to any locality it has recently occupied. The sense of direction is susceptible of analysis into two components. The first component is a constant knowledge of the position of a locality in space. It is internal in origin; that is, independent of the environment, except in so far as the sensation of space is attached to the external world, and is probably a capacity to sense the position of the objective in terms of the bodily displacements in space experienced during the outward journey. The second component consists of the means of keeping a true course. In birds it is external in origin; that is, dependent on the environment. The wide surfaces and extensive lines passing through the visual fields are used not to direct the course followed, but to preserve the straightness of the course originally projected from the starting point. The object is attained by the maintenance of an equality of the distances extending from the bird to related surfaces and lines passing through the visual fields. Deviation from the course is indicated by an angular distortion appearing in the apparent paths of the surfaces and lines occupying the visual fields. Deviation is corrected during flight by an involuntary declination of the long axis of the bird's body contrary in direction and sufficient in degree to neutralize the rotation or distortion then apparent in the fields of vision.

NOTES ON THE BIRDS AROUND CARDIFF.

By J. BLAKE.

THE Mistle-Thrush, Song-Thrush, and Blackbird are very common in the neighbourhood of Cardiff, and their nests can be found almost anywhere. They are all early breeders, and nests of all three are commonly found in March. The Ring-Ouzel is scarce, though last year a pair bred at the Alp's Quarry, near Cardiff, but the nest was robbed. I could tell the bird by the white patch on its breast. This is the only pair I have met with breeding in this district. The Whinchat and Stonechat are both fairly common and breed regularly. The Robin, of course, is very common. Last year I found a nest in a tool-box in a shed, and the birds succeeded in hatching out four young, although the door was locked for the greater part of the day. The birds entered the shed through a crack in the side.

The Greater Whitethroat is common, but the Lesser Whitethroat is rather scarce, although I came across several pairs breeding this year. One nest I found was situated about five yards from the nest of a pair of Greater Whitethroats. The Blackcap and Garden-Warbler breed regularly, the latter being the scarcer.

The Golden-crested Wren, Willow-Wren, Wood-Wren, and Chiffchaff breed regularly.

The Nightingale, although it is becoming scarcer, usually breeds every year. The Reed-Warbler and Sedge-Warbler breed regularly in suitable localities. Last year I came across a pair of Marsh-Warbblers breeding near St. Fagans, which is, I think, the first time they have been observed breeding in Glamorgan. The nest contained three eggs, bluish white in ground colour and blotched with dark brown, but unfortunately these were taken.

The Grasshopper-Warbler is scarce, but a pair usually breed on the Court-y-ralla Estate, near Cardiff.

The Hedge-Sparrow, Linnet, Chaffinch, Greenfinch, and Wren are very common, and breed regularly.

The Dipper is scarce, as there are not many suitable localities for it in this district. A pair usually breed at Radyr Quarry, although there is no rushing water there; but in all probability the birds frequent the River Taf, which is not far away, and flows very rapidly at that point. The nest is always placed in a fissure of the rock, and the birds breed very early.

Of the Titmice, the Long-tailed Tit, Great Tit, Coal-Tit and Blue Tit are common, and breed regularly. The Nuthatch breeds occasionally.

The Pied Wagtail is very common, but their nests are very hard to find unless the parent birds are carefully watched. The Yellow Wagtail usually breeds in this district.

The Meadow-Pipit and Tree-Pipit breed regularly, as does the Skylark. The Spotted Flycatcher is very common and nests almost anywhere. The Red-backed Shrike is on the decrease, but it still breeds regularly.

The Swallow and Swift are very common, but the House-Martin is on the decrease. The Sand-Martin breeds regularly.

The Tree-creeper and Goldfinch breed regularly.

The Tree-Sparrow is scarce. I have observed a few pairs breeding at Radyr, and a pair bred at Llandaff Fields a few years ago. The Bullfinch is very common, and a pair breed regularly in Radyr Woods. The Yellow Bunting is very common.

The Magpie, although persecuted by gamekeepers, continues to breed in fair numbers in this district. The Jackdaw is very common, and there are large colonies at the Alps Quarry and the Little Garth. The Carrion-Crow is fairly common.

The Rook is very common and there are several large rookeries in the district.

The three Woodpeckers are to be found in our district, the Green Woodpecker being very common. The Kingfisher is fairly common, and I have seen three in one morning along the River Taff. The Cuckoo is very common.

The Barn-Owl is dying out around Cardiff, but last year I came across three pairs breeding within a few yards of one another. There was a clump of trees, about half-a-dozen, in

the middle of a field. In this clump of trees I found the following nests:—Carrion Crow's, Kestrel's, and the Barn Owls'. The Kestrel's nest was in the same tree as a pair of Barn-Owls', and was situated in a kind of shelf in the tree, the bottom of which was covered with fine wood. The Kestrels succeeded in hatching out four young, but the Carrion-Crows were less fortunate, as the hen was shot before the eggs were hatched, and I found her dead under the tree containing the nest. Two pairs of Owls hatched out their young successfully, the third having their eggs taken. The latter pair had their nest, if such it can be called, at the bottom of a hollow tree, the entrance being about three feet from the eggs. Once, on climbing the tree, I found the two birds asleep on the eggs, and it was not until I actually caught hold of them that they woke up! The nest then contained three eggs, but these were afterwards taken. Another pair had their nest in a kind of tunnel branching off from the middle of a hollow tree. At the bottom of the tree there was a large hole. Once, on approaching the tree, I heard a loud shuffling noise inside when, all of sudden, four fully-fledged young Owls came out of the hole at the bottom of the tree and flew leisurely away. I hope these Owls will return next year, when I hope to make further observations.

A pair of Barn-Owls breed regularly in a hollow tree in Llandaff Fields, although hundreds of people pass the tree every day.

The Sparrow-Hawk, although decreasing every year, still breeds regularly in certain localities.

The Ring-Dove is exceedingly common and breeds regularly.

The Wild Duck is very common, and I have found its nest far away from any water. The Moorhen is the commonest water bird in our district, and it breeds near almost any pond.

The Ringed Plover and Oystercatcher breed at suitable places along the coast.

The Lapwing is very common, and I have found as many as twenty-six eggs in one afternoon, all within the radius of a mile.

The Herring-Gull is the commonest Gull in this district, and in the winter large flocks come to Llandaff Fields and Cardiff

Arms Park to feed. They breed at the Steep Holm and at suitable places along the coast.

The Little Grebe breeds occasionally, and I was pleased to see a pair breed at Fairwater last year. First of all, one egg was laid but this was taken. The bird laid more eggs but these were also taken. She then built a fresh nest and laid six eggs. Four of these were taken, but she laid two more, and finally succeeded in hatching out four young.

In the winter, small flocks of Snipe may be seen in fields around Cardiff, and a few pairs remain to breed.

In addition to the birds above-mentioned, the following breed either occasionally or regularly:—Corn-Bunting, Reed Bunting, Coot, Corn-Crake, Stock Dove, Hawfinch, Heron, Jay, Merlin, Partridge, Pheasant, Lesser Redpoll, House-Sparrow, Mute Swan, Wheatear, Wood-Lark.

A DIARY OF ORNITHOLOGICAL OBSERVATION MADE IN ICELAND DURING JUNE AND JULY, 1912.

By EDMUND SELOUS.

(Continued from vol. xviii. (1914), p. 225.)

June 22nd.—(I cannot now account for the intervening days.)

I have been alone in my tent with the Merlins again, from a little after midday when it was first pitched. There are now young in the nest, and the female bird sits covering them, as though she were still incubating, but raised a little higher. At about 12.50 p.m. there is the twittering call of the male, and the female flies off. I hear one or both of them crying in the near neighbourhood of the nest, and, at a minute or two before 1, the female returns, but I cannot make out that she brings anything with her, or feeds the young. She continues to brood them merely, and, very shortly, flies off again, and, through the window of my tent, I am now able to follow her. She makes a sweep down the mountain side, then back again, and perches on a salient stone. From this, she in a moment flies down the mountain again, and circles over the flat lands below, as though with a view to seize prey. Nothing comes of this, however, and, in another minute or so—at about 1.15—she returns, unladen, to the nest, and once more broods her young; the latter look very small, and as though they had not long been hatched. This sortie seemed to be quite on the hen bird's own account—there was no sign of the male—yet she has not caught anything in it, either for herself or the young. At 1.20 p.m. she sweeps suddenly down from the ledge, without any cry or warning. Then, sweeping up again, over the side of the gorge, she perches on a jagged piece of brown stone, the mountain being strewn with these. I hear a twittering, but it does not appear to proceed from her, and, the next instant, she jumps from the stone and seizes something quite near it, upon the ground. Then, flying with this to another stone, she begins to devour it. Clearly then this cry (which was repeated once or twice) came from the male, or, at least, which is more essential, he had come, for the female simply swept from the nest to the stone, and had nothing when she alighted upon it. What she seized on the

ground must have been placed there for her by the male, who, like the male Sparrow-Hawk, seems to play the part of purveyor in the domestic economy of the nest. I watched the female feeding for a minute or two, but in trying to focus the glasses a little better, though they were well enough as they were, I lost her, and could not pick her up again on the great hillside. In another moment or two, however, she flew on to the nest, carrying something which I could not recognize, but which I thought looked like a large greyish mouse. Standing upon this, she tore piece after piece from it, giving most of them to the chicks, but sometimes swallowing one herself. She then, at 1.30, brooded the chicks, so that the feeding took ten minutes. I could clearly see that some portions of what the chicks received represented the intestinal canal, whilst others, from their dark red—almost black—colour, seemed to be the liver or some other internal organ. The chicks all stretched up in the nest to receive their portions, so that one of the eggs cannot have been hatched, for there were five. Their coating of down seems, at this early age, to cling close to their bodies, suggesting a sheared sheep. The chicks did not behave themselves greedily. There was no undue eagerness or snatching from one another.

1.58 or 1.59. Female off in silence and without any warning, so that I only know of her departure by looking up and finding the ledge without her, a moment after she has been there. I then go to a higher point up the side of the gorge, from which I can look down into the nest. I cannot make out any kind of remains in it, though they ought to be plain enough, if there—the unhatched fifth egg lies there conspicuously (in its original position apparently), the chicks being four in number. Before I got to the tent, again, the bird was back, and flying round with anxious twittering—there seems to be only this one cry. As soon as I had entered the tent, however, from the end away from her, I saw her on the ledge again. She had brought nothing in with her.

2.40. Bird off in silence, as before, but this time I see her take flight. I follow her for a little, lose her for a moment, then, glancing up through the window of the tent see both her and the male, one above the other, pausing, as it were, in the air—he uppermost, as though they had just met or were about to

meet. Then she sweeps away to the nest, and he passes once or twice before it, from side to side of the gorge. It looks as though the female, having seen the male, had expected him to be bringing her something and flown to receive it of him, but if so she was disappointed, and returned unladen to the nest, having hardly been away a minute.

3.37 p.m. Bird off, and returns, unladen, at 3.42. She went silently and suddenly, and there was no cry or other sign of the male. In less than another minute she again sweeps away—all as before—returning very shortly, and then again, about 3.46, and returns at 3.50, still unladen. In the interval between one or other of these flights, she walked a little way out of the nest, along the ledge, pulled at or picked some of the grass, laid it down, or made as though doing so, and then went through some of those curious actions which I have recorded of her, and also once of the male, during the incubatory period. These can now have nothing to do with the eggs, nor, being made outside the nest, with the chicks either. Inferentially, therefore, they have nothing, at any time, to do with them—they are not domestic actions. They follow, however, upon the pulling or plucking of grass, which is a nidificatory act, and have before been gone through on the nest itself, so that here we seem to have the true bond of association. Yet what, in themselves, can such movements—or some of them—have to do with the actual construction of the nest, and why do they so closely resemble those which, in another bird—the Peewit—seem to proceed out of a sort of sexual frenzy, but, as a result of, or, at least concomitantly with which, a nest-like depression in the ground is produced?* All this we can understand by supposing that it is out of such mere physiological movements that the nidificatory instinct has been evolved. It is easier to imagine the process by which sexual display may also have grown out of them, and, for my part, I have little doubt of this.

A little after this, there is the twittering of the male Merlin, more faint than usual. The female does not seem immediately to remark it, but, all at once, as though she did, she flies over

* From more recent observation I can now say that, to a certain limited extent, the male Peewit *lines* this depression. The actions alluded to I have already described in the 'Zoologist' for April, 1902. When last witnessed they seemed to me even more salient, showing how marked and peculiar they are.

the side of the gorge as usual; it is always the same side. She dips just behind the shoulder of a little rise, near to and parallel with the next ravine (just where she has before, when the male has come in whilst she was incubating) and from above this, in a few moments, go up some white or lightish-coloured objects which have all the appearance of feathers. All at once I see the male bird standing higher up the slope, and, in a little, he flies in the direction of where the female has disappeared, and disappearing himself, in the same way, an instant afterwards more feathers fly up. Then, shortly, the female appears, carrying in her claws the body of a dead bird (as is soon evident), from which a great part of the feathers seem to be gone. She carries it to the ledge, and the male follows her there, and seems almost on the point of alighting, as if protesting playfully against this appropriation—I mean it has that appearance. The young are then fed—the same decorous scene as before. Their mother gives them small bits, and eats larger pieces herself. There is once a feather on a piece received by one of the chicks. He seems embarrassed by it, and the mother pulls it off. A big piece, partially feathered, she takes back and swallows herself, feathers and all. At 4.10 p.m. she flies off, makes some swift, graceful circlings—disporting herself apparently—and comes in again at 4.12. The feeding is not resumed, so that it has occupied a quarter of an hour—for it commenced at 3.55. In this instance, too, therefore, there can be no doubt that the male has brought in prey—a bird—which he has placed somewhere, and to which the female has flown. It is his business, evidently, to provide food for his wife and family, and hers to distribute it to the latter. From feathers going up again immediately on the disappearance of the male behind the rise, it looks as though he helped in this—it is probable indeed that he does the greater part of it where he first strikes down the prey. At 4.25 there is the twittering of the male again. The female turns her head about, looks surprised, as though she thought it a great deal too soon, and does not leave the ledge. She remains with the chicks for over an hour and a half, and then, at 6.5, goes suddenly off, and it is she, I think, who now twitters as she flies about. She shortly passes from my sight, and I do not see any meeting between her and the male, though

a subsequent crying which I hear may well be his. But at 6.9, only, I see her back on the nest and feeding the young, she having taken me by surprise. Through the glasses I have a very good view of her eviscerating the body of some creature, which an adhering feather, here and there, soon shows to be a bird. But these feathers are so occasional that it must certainly have been plucked, and for the mother not only to have caught but to have plucked a bird in something less than four minutes from leaving the nest does not seem probable. I have no doubt but that the male, as on previous occasions, has brought it for her. At 6.16 the feeding is over, and the bird, suddenly diving from the ledge, makes some beautiful upward and downward darts, curves, and circlings, apparently in pure joy of the motion—a well-earned recreation she seems to consider it, after the long and faithful performance of her parental duties. Yet, at 6.18, only, she flies in, again, and broods the chicks.

I now leave the tent, and return to it, again, at 8.30, to find the female bird still on the nest—to be sure she may have left it during the interval. At 8.50 there is the cry of the male, and, in an instant, she is off. I cannot follow her far, nor detect the meeting, though I still hear the cries. At 8.55 the female returns with a dead bird in her claws, which she lifts, with her beak, into the nest, holding it by the nape of the neck, so that it depends in a very corpse-like manner. Then, with repeated picks down and pulls up again, she feeds the chicks, and it is easy for me to see the process of disembowelment—a somewhat ghastly spectacle. Here, too, the feathers are not much in evidence, and must have been removed to a considerable extent. This fierce bird, but tender mother, feeds her chicks liberally, and, as usual, makes her own meal with theirs, swallowing a great mass at the last. She still gives them small pieces, though occasionally a bigger bit is accorded. Then suddenly, at 9.6, she sinks from the ledge, takes her usual little flight of a minute or two, returns, and broods the chicks. I then go to bed.

June 23rd.—The female is on the nest when I look, at a little past 7. She seems completely to cover up all her four chicks, and the feathers of the lower part of her body are often a good deal puffed out beyond the usual contour-lines. At 8.36 the nest is all at once empty (except for the chicks) when I look, my eye

having been upon the brooding just before. A few moments previously I had heard the squeaky little cry of the male, but subdued and low-sounding—the birds latterly, I think, have become more silent.

8.38. Female back and feeds chicks, which takes only four minutes. It would seem, therefore, as if the prey had been "broken up" on the ground, and she had only brought in a piece of it. This must, I think, have been the case, as I could not even catch sight of what she had. At 9.25 she leaves the nest and walks almost to the end of the ledge. It ends in a little immature hill; this she partly ascends, and begins to pick at the green growing grass upon it. She does this in a determined way, but I cannot quite make out that she does more than peck and pull at it—whether she actually plucks it, I mean. She then comes back, and when near to the nest does the same with the browner and less fresh-looking grass there. At 10.12 she goes off the nest, with a flutter, and is back, with prey, before 10.13. The chicks are then fed, which takes till 10.19 only. The male, I think, must have come close up, this time, but I heard no twitter—all was in silence. Going higher up the slope, so as to look down into the nest, it does not appear that the bird really covers her chicks. They lie now, at any rate, for the most part, uncovered just in front of her, and she sits with her wings down on either side, spread so as to touch the ground—the nest, by the way, is hardly more than the bare ground—as though to shield them. But my approach may have something to do with this, for I cannot look down into the nest without the bird upon it seeing me, and she may perhaps have detected or suspected me a moment or two before I peeped over the edge of the parapet.

At 11.2 or 3 a.m. the bird goes off, and, as she flies, I both see and hear the male, who takes his stand a good way off on the slope of the hill. The female comes flying towards him, and, when just over his head, makes, as she skims along, a little dip down, which may or may not have been sufficient to enable her to take something from him, but certainly not from the ground. She passes on, over the top of a rise, some way off, and, in a moment or two—about 11.15—is back at the nest, bringing nothing with her. There has, I think, been no further meeting between her and the male. My reading is that the dip down of

the female bird towards the male, as she skimmed over him, was on the expectation of his having brought in booty, which was either not the case, or else he withheld it from her, probably the latter, for in another two or three minutes only the cry of the male is again heard, the female again flies off, and returns, now, almost directly, with something with which she feeds the young. At 12.55 the male cries and the female goes off. She returns with prey, in a few minutes, feeds the chicks, and, at about 1.5, flies out again. She is soon off, but soon back again, and is now away till 1.38—this and once before, during the incubatory period, when she left it for twenty-eight minutes, make her two longest absences from the nest. During a part of this time the male is in my sight, standing first on one promontory of the walls of the ravine, and then another. I watch him for some time, wishing to make sure of his identity, and whilst I am doing so he rises, and, following him with the glasses, I see him descend upon the female, who is standing on a similar prominence, a little way on, and coition is effected.

At 1.53 the female again flies off the nest, in response to the cry of the male. I watch her down over the brow of a rise, in good view, but which just hides her. In just a minute, however, she returns with a bird, and feeds the chicks, a long white entrail playing a prominent part in the meal. The mother gives them small bits of it, for the most part, and twice when they have a larger piece, she removes it, again, from their bills, and swallows it herself. This is not done greedily, but carefully. The chicks also feed decorously as they have hitherto. Neither now or upon any former occasion has there been anything that can be called plucking or pluming of the bird brought in, upon the nest; a feather or two may have been removed, but nothing more important. Evidently the nest is not thought the right place for this preliminary. As for the species of bird forming the prey, both now and generally, I can only go by probabilities and suppose it to be the Meadow-Pipit, which is very common over the land here, but in this I may be mistaken, the more or less plucked and always (I think) decapitated state of the victim making it difficult to judge. Its size has generally seemed to me to favour this supposition, but, where only portions have been brought in, these may have been of a larger

species, Phalarope, perhaps, or Golden Plover, though I hardly think so.

After this I leave the tent and try to take up a position from which I may be able to see the actual transfer of prey from the male to the female Merlin, or the depositing of it by the former, but this I am unable to do. The small size of the birds, and the huge scale of the land contours they fly over, with the frequent rises and depressions, makes it difficult to follow them for long, or to pick them up again, when lost. Later in the afternoon, the female bird flies from the home-rock to the opposite side of the next ravine, and, coming down on a rough, stony surface, seizes something which is evidently a bird, for, as she bends her head and raises it again repeatedly, I see feathers flying about, showing that she is plucking the corpse. As she has flown straight to the spot and there has been the cry of the male just before, I make no doubt that this bird has been brought in for her by the latter, who may be quite near at the time. I see him shortly afterwards, in the neighbourhood, and, a minute or two later, the female flies to the nest again, but not carrying anything. She has either stored the prey—in which term simply leaving it where it was must be included—or made a meal off it herself. Upon my return to the tent, I re-pitch it in a different position, taking in a wider view of the surrounding country. It is 7 p.m., or thereabouts, by the time I get inside, and at 7.6 the female bird, having left the nest in response to the usual cry, flies to it again, with something that suggests the plucked sternum of a small bird, and I can see her plainly eviscerating it for the chicks. Having fed them, she covers them as usual. At 7.14 the male flies up, twittering, and settles on the great hillside. A moment afterwards, the female flies from the nest, and straight to him, and then *at* him, making a little grab, but flying on, without alighting, and disappearing over the edge of the next gorge. Shortly she reappears, though I cannot see from where, and comes flying to the ledge, on which she alights, holding in her claws what looks like a ball of entrails, and with this she again feeds the "little eyases." This takes her till 7.22, when she covers them. At or about 7.30 there is the cry of the male Merlin. The female remaining on the nest, he twitters again, and continues to do so at short intervals,

loudly and insistently, till she flies from the ledge. I have the glasses on her, and follow her with them. She crosses the home-gorge, perches on a salient point just above it, and rising again, immediately, as if she saw something, flies back to her own nesting-rock, on the top of which, as she descends upon it, the glasses show me the male, and from him, with the same little grab as the time before, I now see her take, if not actually receive, the prey—it is either from his claws or from the ground just beside them, as he stands, which seems more probable. With it she flies, once more, across the ravine, and coming down amongst a lot of black stones (or cinders) on the slope of the mountain, I see her transfer it from claw to beak and deposit it there. She then flies straight to the nest, bringing nothing, and covers the chicks. The whole episode has taken about a minute. Here then, at last, is the actual ocular proof (though hardly needed) of the male bringing in food for the female, with which both her own needs and those of the chicks are satisfied. If the supply is superabundant, or comes in too quickly, the female apparently leaves it here or there on the ground—what I have seen more suggests this than that there is any special storing-place or larder. If she is hungry and the young have had enough, she makes her meal away from the nest, but otherwise (or perhaps generally in any case) she eats something of what she brings them. That the female is also fed by the male during incubation is probable, for she sits almost constantly, at least during the last part of the time, and there are the same periodical visits, announced by the same twittering cry. Once, too, I have unmistakably seen her devouring something immediately or shortly after going off to the male. But that the latter is, at this time, far less assiduous in the bringing in of supplies than after the hatching of the eggs is also apparent. All this corresponds closely with the domesticities of the Sparrow-Hawk, but I have not yet, with these Merlins, seen a transfer of food in the air, though once there was a suggestion of it. With the Sparrow-Hawk this seems to be the ordinary way. This last was the nearest approach to the nest, with his booty, that I have seen the male Merlin make. He once followed the female almost on to the ledge, but he had then already made delivery to her.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

A Grey Hare.—As we were beating a small allotment ground between here and Milcomb on September 19th last, a Hare got up at my feet. My companion's small boy was walking between us, and we were just wheeling. The Hare went straight for the boy, passing close to him, and went on in that line, so that I could not shoot at it. It was quite grey; not the colour of a wild Rabbit, but more like that of the domesticated variety called the "silver-grey." We could never find it again anywhere round there. Hares do not try to stay long in allotments; and this one had probably come out of some barley field when it was cut, and was on the move. Although I was told it had been seen, I never heard its fate; but so many Hares disappear quietly! This is the only time I ever saw a variety of the Hare in a wild state.—O. V. ARLIN (Bloxham, Oxon).

Elephant Scratching with Fore-foot.—When the baby Elephant from the Malay Peninsula was exhibited at the Zoological Gardens a few years ago I noticed on two occasions that it employed its fore-foot when scratching itself on the flank. This struck me as a most remarkable action for an ungulate, even for one which, like the Elephant, has limbs of a far less specialized type than the order generally. As far as my observations had gone, mammalia only scratch with the fore-foot when they have the habit of using their fore-feet as hands; thus I have seen Monkeys, Kangaroos, and the Coypu Rat (*Myopotamus coypus*) scratch in this way. It would be interesting to know exactly what animals use the fore-foot in scratching themselves, and also when, if ever, the Elephant gives up the habit, if it prove to be a usual one. I have had but few opportunities of observing small Elephants, never having seen in India any individual as small as that above remarked on, or as the one exhibited previously with the King's collection from India.—F. FINN.

Mouse surviving a Fall from a Height.—The activity of *Mus musculus*, in comparison with allied species, has been commented on, but its endurance appears at least equally remarkable, in the light of an experience I had when at Oxford, and remember quite vividly, though it was a quarter of a century ago at least. I had caught the Mouse in one of the ordinary live-catching traps, and, thinking to

kill it more mercifully than by drowning, dropped it out of my window, which was at least three stories up—it might have been four. It fell on the hard gravel of the quadrangle path, but was not even stunned, running about—perhaps in a rather confused way—until one of the college servant boys saw and crushed it. I have also seen in Calcutta a Gecko Lizard fall down the well of a staircase from at least three stories up, landing on a stone pavement with a smack, and yet run off all right. Perhaps the small size of these creatures accounts for their endurance?—F. FINN.

A V E S.

Green Sandpiper (Totanus ochropus) in Stour Valley.—On January 12th, 1915, Mr. Richardson, of Flatford, Suffolk, shot, out of a flock of small waders which were feeding in the flooded meadows in the valley of the River Stour, a bird he did not recognize. It was sent to me for identification, and I saw it was a specimen of the Green Sandpiper, and as Christy ('Birds of Essex') says it has not been found in Essex during January, it may be worth while to record it. The River Stour divides Essex from Suffolk, and a bird shot in the meadows near this river may be considered to belong to either county.—HENRY LAVER (Colchester).

The Meaning of "Katones."—The 'Itinerarium Wilhelmi Botoner,' commonly called "William of Worcester," was written about the end of the fifteenth century, and contains an early mention of St. Tudwal's Island and its birds. Writing in 1478, he gives some account of the islands off the Welsh coast. After mentioning Bardsey ("Berdesey," it is spelt; and this suggests that it simply means bird-island, and has nothing to do with bards) and its twenty thousand saints, and "Mewys-island" (still called Gull Islands, for there are two), he goes on:—"Insula Lastydenale in Wallia sequitur proxima insulæ de Meulx, ex parte orientali de Meulx-island, . . . et non est populata nisi silvestres herbas, aves vocat mewys, kermereretes, et katones, et muscæ id est mowses." The book is supposed to be written in Latin, but French and English words are introduced freely. Moreover, the author evidently wrote down place-names and others from ear, and often got them more or less wrong, so that it is not always easy to identify islands. Some help can be had from Camden's maps, though both authors use names not in use now. "Lastydenale" would have been a greater difficulty had not the author repeated it further on, and then spelt it *Lastydewale*. It then became quite clear that he meant St. Tudwal's (pronounced Tydwal's),

and had terribly corrupted the name by going by ear. Possibly he had some idea of prefixing the French article. But even Camden prints the name "Stidwall" on his map. "Meulx-iland" must be a corruption of Mercross Island, used by Camden, but not used now. I should be very glad if any reader of the 'Zoologist' could suggest what "Katones" can be. One's thoughts naturally fly to Shearwaters; but I have been unable to find in any old book a name anything like "Katones."* Shearwaters are now called "Mackerel-cocks," but no *old* name for the bird seems to have been preserved in print for any part of England or Wales. Of Flatholm the author writes, "Repleta cum cuniculis." And his use of languages may be judged from what he writes of Puffin Island:—"Insula Prestholm proxima insulae Anglesey, . . . et ibi crescent cuniculæ et serpentes addyrs snakes, et arbores vocat elders; . . . et est ibi unum bay pro navibus salvandis in le north side insulae vocat le round table."—O. V. APLIN (Bloxham).

A Letter from Thomas Pennant.—The following letter in my possession, written by Thomas Pennant to William Borlase (author of the 'Natural History of Cornwall,' 1758), endorsed 27th October, 176—(last figure doubtful), is, I think, worth printing:—

"DEAR SIR,

"I am obliged to you for your favors, and greatly so for promising Mr. J. St. Aubyn's subscription to the Society. Mr. Morris, our President, tells me He has not heard anything of it, so I fear Mr. John's orders are neglected. I have received your valuable present of the 'History of Cornwall,' and as soon as the first Part of British Zoology appears I will send you an order for a copy of it. I am quite happy that we have at last settled the Dispute about the Identity of the Cornish Gannet. As you observe, the figure in Willoughby is wretched; but you will now see it finely executed (from a fresh subject) in the work in hand. You will find in the first Part three Birds that are styled Cornish, the Gannet Tarrock and Daw. Pray send me a brief Nat. Hist. of the first. When does it first appear: When go off: Are they very common with You &c.? Does the Tarrock breed with you; in what sort of place. As Birds go by different names I should still be glad to see all those you mention; for that is the only secure method of conviction. Be so good as to tie a label to the Leg of each with its name and color

* Might not "Katones" be a misreading for "Kahoues"? "Cahow" is a known West Indian word for a Shearwater.—ED.

of the Irides ; and if you can send the weight and measures ; and pack them as dry as possible with something between each. The great grey Gull of your County I never saw. The Hagden or dark brown Gull is quite new to me and probably non descript. Therefore be assured I shall be impatient to see them. Direct the box to Richard Morris Esqre. at the Navy Office and advise Him of the Time and method of conveyance. I hope Mrs. Borlase is better than when you wrote last. I beg my compliments to her and am
Dear Sir, with . . . esteem,

“Your most obedient Ser.,

“Bychton. Octr. 27th.

T. PENNANT.”

The really good figure of the Gannet in the ‘British Zoology’ was evidently executed, as Pennant says, from a fresh subject ; and the specimen killed on September 30th, 1762, and sent to Pennant by Borlase was doubtless a preserved’ skin. With it Borlase sent the “brief Nat. Hist.” of the bird asked for, which Pennant printed *verbatim* in the ‘Zoology.’ The Great Grey Gull is believed to be the *Larus marinus* in immature dress, but it might have been a Glaucous Gull in some cases. The Tarrock is of course the young of the Kittiwake. Pennant, once converted to this view, retracted the opinion in the 1776 edition. Hagdown is a name given to the Great Shearwater, and the “Hagden or dark brown Gull” was doubtless the Sooty Shearwater (*Puffinus griseus*), and this is perhaps the earliest mention of it as a British bird.—O. V. APLIN (Bloxham).

Stone Pellets Cast by Curlews.—Wandering, lately, along the east side of this island (Cumbrae), I came to a stretch of grassland, 150 ft. above sea-level, where I found a pellet of small white stones—chiefly bits of quartz—which had obviously been brought up from the shore. I wondered what bird could have brought them there until, further along, I found a number of small heaps of stones with occasional bits of sea-shell amongst them, which proved to be similar pellets which had been washed down by rain. Finally I realized I was on a favourite roosting-place of the Curlews, which I had noticed them frequenting lately. Last Sunday I heard a few Curlews calling at night in a similar grassy hollow above my house, which they have not frequented lately ; to-day I went up there and found two pellets. The pellets are about one inch long by half an inch broad, and consist of thirty to forty small bits of quartz, and weigh about four grams : some of them contain a few bits of shell, and one consists almost entirely of shell. Judging by the numbers of pellets found on the roosting-place, I should say that they are formed

occasionally and cast in the morning. I hope to be able to verify this by actual observation, but owing to the wariness of the Curlews it may not be possible to do so.—RICHARD ELMHIRST.

PISCES.

Long Rough Dab in the Irish Sea.—In the 'Victoria County History of Lancashire' it is stated that the Long Rough Dab (*Drepanopsetta platoeoides*) is very rare in the Irish Sea, indeed, so uncommon that there is no local name for it. The author adds that he has seen three or four specimens taken between Lancashire and the Isle of Man. In view of its rarity, it may be of interest to state that in July, 1909, the Common Terns on the Cumberland and North Lancashire coastline were feeding their young on very small specimens of this fish, of which I found a fair number on the nesting sites. In July, 1910, only a few odd specimens were seen, and in 1911-12 and 1913 it was entirely absent.—H. W. ROBINSON, M.B.O.U., F.Z.S.S. (Lancaster).

A Correction.—In a paper on "The Fauna of Reservoir Plants," published in the 'Zoologist,' vol. xviii., May, 1914, the present writer made the following statement on p. 185:—"In the Hawaiian Islands a species of *Eriocaulon* provides a habitation for the larvæ of a Culicid and for a species of Cyclopid Crustacean." Dr. A. Lutz, of the Instituto Oswaldo Cruz, Rio de Janeiro, who made this discovery, has called the writer's attention to the fact that it occurred in *Brazil*, not in the Hawaiian Islands. Moreover, the *Eriocaulon* should be described as growing in, but not as actually floating on, a marsh. Dr. Lutz referred to the matter in 1903 (Centralbl. f. Bakteriologie, Abt. 1, vol. 33, p. 291). The writer's apologies are due to him for this erroneous citation from his work. On the following page (186) of the paper in question, in referring to the fauna of *Pandanaceæ*, it was stated that these plants are trees with stilt-roots, and that various animals have been found between their leaf-bases in the Hawaiian and in the Seychelles Islands. This statement might have been more explicit. In the Seychelles the plants in question are indeed trees, being more than one endemic species of the genus *Pandanus*; but in the Hawaiian Islands the species referred to was a climbing member of the *Pandanaceæ*, *Freycinetia arnotti*, and the creature found in it was an Amphipod Crustacean of the genus *Orchestia*. This latter discovery was also made by Dr. Lutz, and is mentioned on pp. 284-5 of his work cited above.—HUGH SCOTT (University Museum of Zoology, Cambridge).

NOTICES OF NEW BOOKS.

Water Reptiles of the Past and Present. By SAMUEL WENDELL WILLISTON. University of Chicago Press.

PROFESSOR WILLISTON's book, well illustrated by figures, many of which are by himself, is a welcome addition to the literature of extinct animals, more especially as particular endeavour has been made—and made successfully—to make the subject understandable to the non-scientific reader. The extinct sea-reptiles have always enjoyed a particularly widespread reputation, their remains being so numerous and well-preserved, so that the Ichthyosaurs and Plesiosaurs in particular are quite well known, as extinct forms go. There is much information about them here which will be new to many who have a general knowledge of them; full prominence is given to the external form of the Ichthyosaurs, now well known by fossilized outlines to have possessed a caudal fin, which Owen inferred they possessed, and several types of Plesiosaurs are discussed and figured, not only the familiar long-necked forms, but others with necks of varying length, including some whose necks were shorter than the head, which was broad. These, therefore, made some approach to the Crocodiles in form, and some of them with skulls five feet long armed with teeth, some of which were four inches in length, must have been more formidable than any other sea-reptiles. The author must be forgetting these when he says that the snake-like reptiles of the Mosasaurian or Pythonomorph group would probably be the only sea-reptiles dangerous to man, were all existing to-day. The Mosasaurs, however, were undoubtedly a very truculent lot, and the frequent injuries displayed by their remains show that they probably fought each other.

Curiously enough, young of this group have never come to light, and it is suggested that they may have been oviparous. In this case they no doubt came ashore to breed, though it is pointed out that their paddles, although less specialized than

those of the Ichthyosaurs and Plesiosaurs, were quite inadequate for support on the land, where, though they might have moved in a serpentine way, our author thinks they never went voluntarily. This is inconsistent with oviparous habits; but, after all, since Eels can move on shore and even travel some distance thereon, there is no reason why these air-breathing creatures could not have done as much. Their remains are so well preserved that even the existence of scales, although very small ones, is substantiated, and even bands of pigment have been traced in one specimen Professor Williston has examined. The shape of the head, as restored, suggests that of the Sea-Eels of the Murænoid type, known to be some of the most ferocious and aggressive of fishes, by modern experience as well as by the tales of wealthy and wicked Romans who used to throw delinquent slaves to their pet Murænas. Professor Williston considers these ancient Sea-Serpents to be "real Lizards, differing less from the living monitor Lizards than do the monitors from some other Land Lizards, especially the Amphisbænas and Chamaeleons," and he remarks that Adrian Camper pointed out their real relationship more than a century ago.

Though not absolutely certainly a true Mosasaur, the recently discovered genus *Globidens* deserves mention on account of its extraordinary teeth, which, according to the life-size figure, had crowns of the size and shape of Barcelona nuts, indicating a diet of shellfish rather than of fishes proper.

Turning to more familiar types of reptiles, it is noteworthy that all the highly-specialized marine Crocodiles or Thalattosuchia have become extinct, while the semi-terrestrial Crocodiles and Alligators remain; specialization in reptiles seems very uniformly to have led to extinction.

The accounts of water-reptiles of the present are far less satisfactory than those of the ancient forms. Much more might have been said of the Sea-Snakes, the only large group of marine reptiles to-day, especially with regard to the genus *Platurus*, which forms a perfect link with Land-Snakes, and whose members often come on shore, unlike all the rest; and with regard to the curious parallelism in development between these Snakes and the Plesiosaurs, some being stout and of nearly uniform calibre, while others taper extraordinarily in the

anterior part of their length, and have very diminutive heads. Something also might have been said about the Sea-Serpent, so often reported by sailors, and within the last few years actually seen by two such well-known naturalists as Messrs. Meade-Waldo and Nicoll, during the cruise of the 'Valhalla.'

Even with more familiar reptiles there are some errors which will need correction in a subsequent edition, in the event of this being called for; it is most incorrect to say that in the Marsh Tortoises (*Emydidæ*) only the two or three middle toes have claws, the normal number of claws being five on the fore-foot and four on the hind; while the Box-Tortoise is not, as stated, strictly vegetarian, but largely an animal-feeder. Moreover, the "Flying Dragons" incidentally mentioned are not Ceylonese, as stated, but have a wide range over other parts of the Oriental region, from Malabar to the Moluccas.

Bulletin of the British Ornithologists' Club, vol. xxxiv. Edited
by W. R. OGILVIE-GRANT. London: Witherby & Co.
December, 1914.

THIS volume is entirely devoted to the report of the immigrations of summer residents in the spring of 1913, and notes on the migratory movements and records received from lighthouses and vessels during the autumn of 1912. It forms the ninth of the series issued by the British Ornithologists' Union Migration Committee; and after the appearance of a tenth report to be issued during the present year, the results of the enquiry will, we are told, be summarized in a final volume, which will, of course, be looked forward to with eager interest by numerous observers. It is noted that increase in the number of records supplied by observers continues, and the Migration Committee particularly congratulate themselves on being able to get returns from the Caskets Lighthouse, which had proved impossible until the appointment of Mr. R. E. Wilson to that station, a very important one for migration movements.

Comment is also made on the numerous instances of summer visitors which had apparently not migrated at all from the south and west, and on the unusually early arrival of others, for which the mild weather is considered—no doubt rightly—to be responsible.

With regard to the localities and arrival of the various species, it is to be noted that the Grasshopper-Warbler and Land-Rail are noted as having arrived only on the western half of the south coast, while the Reed-Warbler, Red-backed Shrike, Wryneck and Turtle-Dove, came in on the south-east coast, from Suffolk to Hampshire. Many species were observed to begin to depart very early in the autumn, but yet there were great migrations during November, even more than during the previous month, the main migrations having apparently been delayed till the middle of the latter. It is gratifying to find, in this connection, that special mention is made of Mr. B. B. Riviere's observations in the 'Zoologist' of 1913, which are stated to have "added considerably to our knowledge of the coasting character of some of these autumn movements." The Report is of course indispensable to all who are studying migration.

The House-Fly. By C. GORDON HEWITT, D.Sc., F.R.S.C.
Cambridge Zoological Series. Cambridge: University
Press. 1914.

It is probable that no more valuable and important monograph of any insect has been published than this, in which Dr. Hewitt, formerly Lecturer on Economic Zoology in the University of Manchester, and now Dominion Entomologist of Canada, discusses from every point of view the most familiar of all insects, if not of all living things. The whole history of the Fly in all its stages is exhaustively discussed, the morphology being thoroughly worked out, while equal attention is given to its reproductive, feeding, and other habits. Natural enemies and parasites are also dealt with, as are other species of Flies frequenting houses, such as the Lesser House-Fly (*Fannia canicularis*) and the biting Stable-Fly (*Stomoxys calcitrans*). These subjects occupy the first four sections of the work, while the last two are occupied with the extremely important subject of the relation of House-Flies to disease, now so widely recognized, and the various methods of control which are being attempted. The work is most fully and beautifully illustrated by both coloured and uncoloured figures, most of them the work of the author.

"It is," he says, "not intended as a popular treatise on the subject," but "primarily intended for the use of entomologists, medical men, health officers, and others similarly engaged or interested in the subject, and it is hoped that it will be of value to students." There is no doubt of this, and it is certainly a work which all interested in general zoology will find invaluable, and one which should be widely disseminated in public libraries.

There is so much of interest in a work like this that it is difficult to make selections, but particular attention may be drawn to some special points. One is the extreme omnivorousness of the maggot of *Musca domestica*, which can apparently extract nutriment from almost any organic substance that is not too dry, though its favourite pabulum, and that on which it develops best, is stable-manure. Another is the curious fact that among its enemies is to be noted the larva of its ally, the Cluster-Fly (*Muscina stabulans*), which attacks and devours the House-Fly maggot, although commonly feeding, like it, on miscellaneous animal and vegetable refuse. The list of diseases which can be transmitted by House-Flies is something appalling; not only are bacteria transferred by the feet of the insect, soiled by contact with filth, to our food and drink and our persons, but the habit of the Fly of disgorging a part of its last meal on whatever it is partaking of at the moment, if this needs softening, is a potent factor in disease-dissemination.

It is also interesting to note that, though the general realization of the danger from this household insect is quite recent, it was suspected as a disease-carrier as long ago as 1577 by Mercurialis, while at long intervals it has been again accused. A very full bibliography, occupying thirty-five pages, concludes this masterly contribution, as valuable to pure science as to the utilitarian application of our knowledge.

Annals of Tropical Medicine and Parasitology. Vol. viii. No. 3.
Liverpool: University Press. December 15th, 1914.

THIS journal contains a very interesting paper by Dr. H. B. Fantham and Dr. Annie Porter, on a new Microsporidium infesting humble-bees, and the diseases it induces in them. The organism in question has been appropriately named *Nosema*

bombi, and is allied to *Nosema apis*, the cause of the "Isle of Wight disease" in hive-bees, of which so much has been heard of late. Although *Bombus agrorum* is the chief sufferer, other species of *Bombus*—*hortorum*, *latreillellus*, *lapidarius*, *sylvarum* and *terrestris*—may suffer, especially the last-named; while the hive-bee, *Apis mellifica*, and *A. florea* may also be affected. The medium of infection is bee-food and drink soiled by the dejecta of infected bees, and even larvae may contract the disease. Different species of humble-bees may also infect each other, and both hive- and humble-bees may suffer at the same time both from *Nosema apis* and *N. bombi*. Hive-bees become infected from the attempts of humble-bees to rob them, and the pathogenic action of the parasite is in them accelerated, while similarly robber humble-bees contract the "Isle of Wight disease" in a virulent form.

The sick humble-bees infected by *Nosema bombi* generally die, often previously crawling about unable to fly, and exhibiting great irritability and readiness to sting. Artificially infected humble-bees have shown the commencing infection in forty-eight hours, and in some districts practically all individuals of *B. agrorum* were found to be infected.

The disease thus assumes considerable economic importance in view of the known services of humble-bees in fertilizing red clover, and the authors recommend as measures in keeping up the humble-bee stock the destruction of all infected humble-bee colonies and dead or dying bees, and the discouragement of the taking of humble-bee nests by children. Considering the part played by Field Mice also in such destruction of nests, the preservation of Owls and Kestrels might also have been recommended in this connection. Another paper with a peculiar if rather gruesome interest is one written (in French) by Dr. J. Schwetz on the morphology and biology of the larva of the fly *Auchmeromyia luteola*, known as the "Congo floor maggot." This is a blood-sucking maggot which infests the floors of native huts, creeping out to attack people who are sleeping on the ground or on low bedsteads. Dr. Schwetz has been studying it at Kabinda, and though forced to leave his investigations incomplete for the present, has yet succeeded in establishing some interesting points in the habits of this

particularly repulsive pest. He finds that the larvæ possess great vitality and powers of fasting; newly-hatched larvæ (which appear in about forty-eight hours after the laying of the eggs) lived for ten to twelve days without feeding, and of three small larvæ which were red, showing they had recently sucked blood, put into a jar on September 23rd, while two were dead and dried up on November 27th, one was still alive and had even increased to a medium size. The pupation of some large red larvæ took place in a week after they had been bottled up. Pupæ, however, were far more delicate than larvæ, and were easily killed by movement of the sand with which they had been enclosed.

In the experimental jars the larvæ burrowed in the sand during the day, but were found crawling actively about on its surface at night, nor did the light of a lamp close by diminish their activity. Yet in nature, so natives agreed in informing the author, the maggots bite by day if one lay down, so that the reason why night was the chief time for their attacks seemed to be that night is the usual sleeping time for humanity.

It is possible, as Dr. Schwetz says, that the influence of these maggots is more noxious than is supposed. At any rate, considering their disgusting character, it is satisfactory to note that they could be kept under control fairly easily, for he found that, after giving rewards to native children for adult flies as well as maggots during a couple of months, he could only get very few of the latter, and those very small and in a fasting state. The fly is a smoky-buff insect with darker markings, and the males, which are nearly twice as numerous as the females, are distinguished by a shorter abdomen.

Transactions of the Paisley Naturalists' Society. Vol. ii. Paisley :
Alexander Gardney.

THIS neat little volume, the frontispiece of which is a coloured map of the county of Renfrewshire, is chiefly occupied by lists of the county plants, Macro-Lepidoptera, freshwater fishes and land vertebrates, accompanied in some cases by notes. The general get-up of the book and the character of the contents reflect great credit on the Society which publishes it, though it must be admitted that misprints are curiously numerous.

Renfrewshire for its size—it is the twenty-seventh in area of the thirty-three Scottish counties—presents a considerable variety of physical conditions, which affords diversity for the flora and fauna. The poverty of the latter in some respects is, however, rather remarkable; thus, among the butterflies, only fifteen species are recorded, and only seven of these are really common; even the ubiquitous small Tortoiseshell (*Vanessa urticae*), which may be seen at times even in London streets, is noticed as abundant in "some seasons." The moths are better represented, but it is curious to read of that confirmed Cockney insect, the Vapourer (*Orgyia antiqua*)—whose larvæ amounted to a plague in London parks a few years ago—as "local; fairly common on moorlands." Among the Amphibia the usually scarce Palmated Newt (*Molge palmata*) is noted as equally common with the familiar *Molge vulgaris*, the Common Newt.

Among the notes on birds, the building of the Mistle-Thrush (*Turdus viscivorus*) on the tops of tombstones, with tree sites available, is noteworthy, as is the persistent residence of the Blackbird (*T. merula*) even in severe weather, when the Mistle-Thrush and many Song-Thrushes (*T. musicus*) emigrate. A very remarkable record also is that of six Gannets (*Sula bassana*) viewed passing over Thornliebank on June 29th, 1892, this place being about midway between the Firth of Clyde and the Clyde estuary, and so many miles from either. The lingering of the Wild Cat (*Felis catus*) up to as late a date as 1895 is a noteworthy record for the local Mammals.

EDITORIAL NOTES.

MR. PATTERSON's notes ('Zoologist,' 1914, p. 4) on several abnormally-coloured Plaice occurring at the same place and time, and being of the same size, are of great interest. He is no doubt right about their being of the same brood, for in animals which lay such numerous eggs as teleostean fish there would be a probability of several abnormal specimens occurring at once. Even with such comparatively infertile creatures as birds, whole abnormal broods may occur. When in India we were told of the existence of a pair of the common Ring-necked Parrakeet (*Palaeornis torquatus*) in the Patna

district, all of the brood of which were always yellow instead of green. They nested year after year in the same tree, and there was great local competition for the young, such lutinoes fetching a high price even in India; this no doubt accounts for their extreme rarity in Europe. The fact that such yellow varieties are now very rarely brought to Calcutta may indicate that this pair, or one of them, has met with some mishap, curtailing the always limited supply of the varietal individuals, for which there is always, as above remarked, a market. In our time in Calcutta we knew of two living examples of the lutino variety, and there must have been about half-a-dozen skins in the Museum, mostly, we believe, contributed by Rutledge, the animal dealer, who informed us of the lutino-producing pair above referred to.

THE MAMMALIA OF HAMPSHIRE AND THE ISLE OF WIGHT.—The Rev. J. E. Kelsall, The Rectory, New Milton, writes:—"Having been asked by the Hants Field Club to write a short account of our Mammalia, I should be very glad of help from your readers, especially in regard to the following species:—The rarer Bats (especially the Lesser Horseshoe and the Hairy-armed), the Marten (certainly extinct), the Polecat, the Black Rat, the Harvest Mouse, the Yellow-necked Mouse, and the Cetacea. The Field Club have already published lists of the birds and reptiles."

We hope readers will be able to oblige Mr. Kelsall, and at the same time swell our notes on Mammalia, a group on which the observations are very few compared with those on birds.

MISS W. AUSTEN writes:—"I was wondering whether it would interest the readers of the 'Zoologist' to know that I saw a flock of about thirty Long-tailed Tits, very lively and talkative, in the garden of Studio 3, Warwick Avenue, Maida Hill, last October 1st. Is this not a somewhat uncommon bird to be in a London garden? After scrambling about in the poplar over my studio, they flew to the plane trees on the Regent's Canal bank. Of course I may be wrong in supposing anything unusual in their appearance in town." Miss Austen is certainly right in thinking the occurrence a curious one; we have personally never seen the Long-tailed Tit anywhere in London that we can remember, though London birds have been a special study of ours for years.

ERRATA.—In 'Zoologist,' January, 1914, on p. 11, *mustella* should read *mustela*; and on p. 25, *strurio* should read *sturio*.

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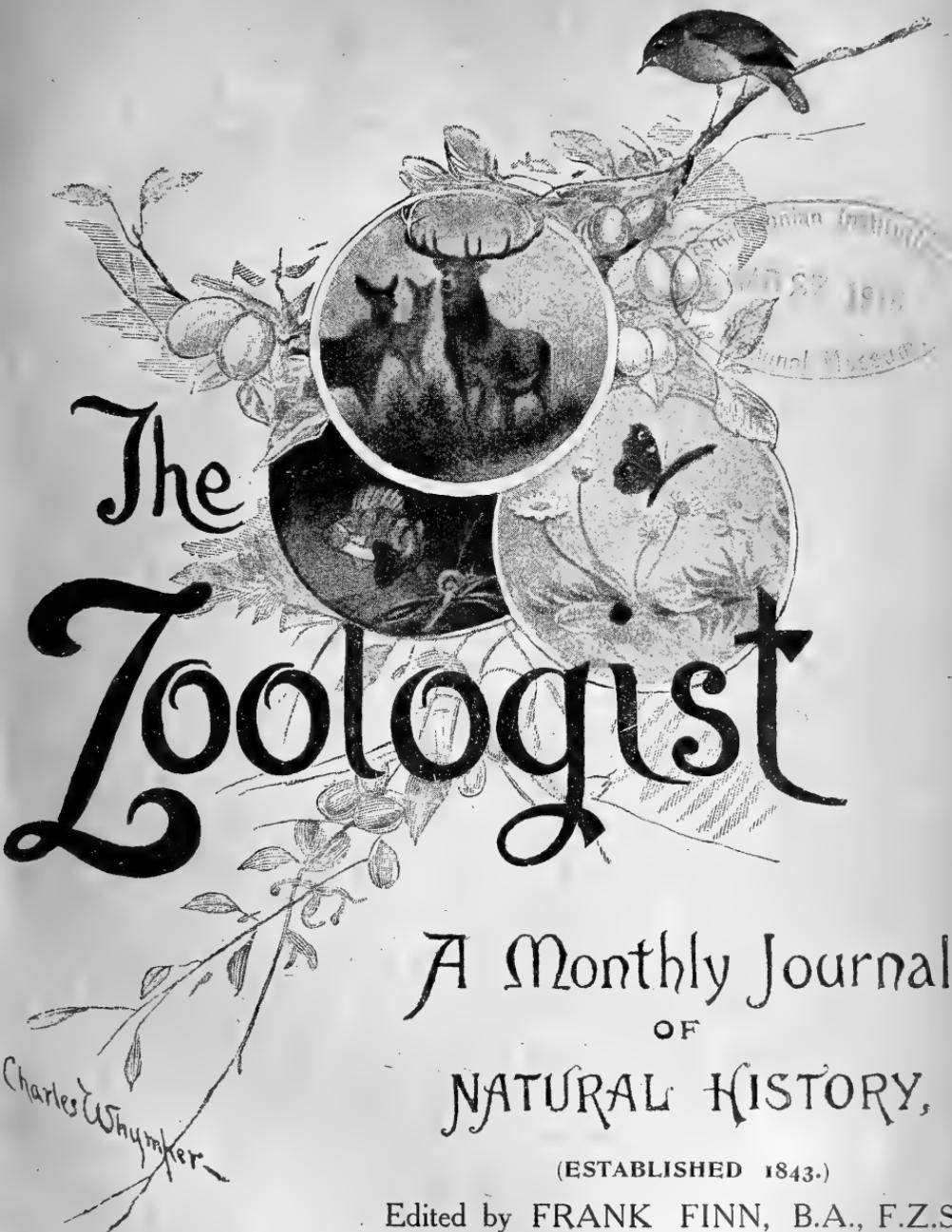
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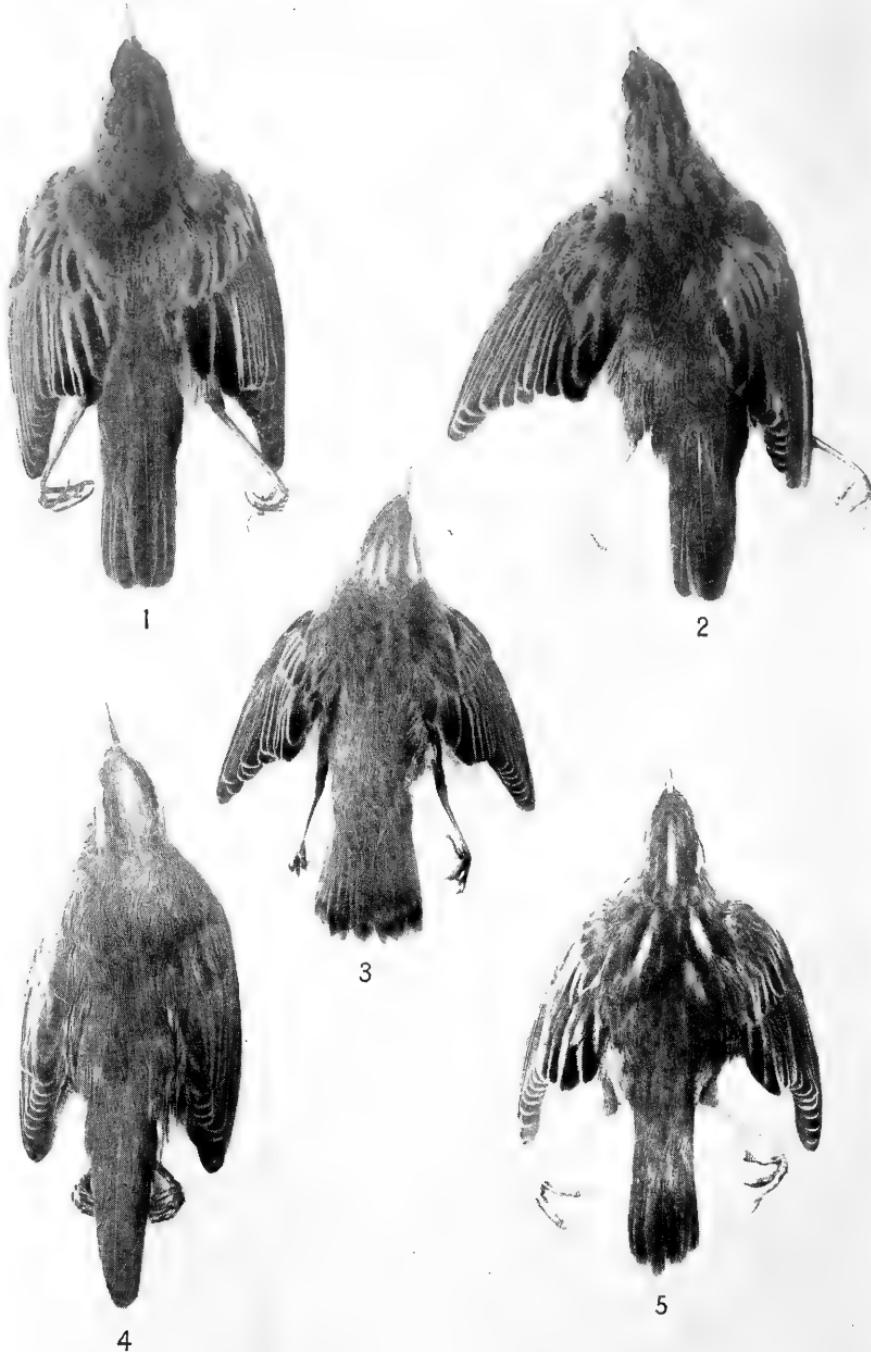
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Photos by C. J. Patten.

SEDGE-WARBLERS (Figs. 1, 2, 3, 4,) and AQUATIC WARBLER (Fig. 5).
 From Tuskar Rock Light-Station. Showing plumage-markings of the upper parts.

THE ZOOLOGIST

No. 885.—March 15th, 1915.

AQUATIC WARBLER ON MIGRATION OBTAINED ON
TUSKAR ROCK: WITH SPECIAL REFERENCE
TO THE PLUMAGE MARKINGS AS COMPARED
WITH THOSE OF THE SEDGE-WARBLER.

By Professor C. J. PATTEN, M.A., M.D., Sc.D.

(PLATE I.)

In the November number of the 'Irish Naturalist,' 1913, p. 220, I published a short preliminary note stating that I had received and identified an Aquatic Warbler (*Acrocephalus aquaticus*) from the Tuskar Light-station, Co. Wexford. The bird was picked up dead on the rock at 4.45 a.m. on Saturday, August 9th, 1913, by Mr. Glanville, principal keeper. At the outset I must acknowledge my great indebtedness to him for so promptly forwarding me this interesting specimen in the flesh on the very morning that he obtained it. I received it on Tuesday, August 12th, at Inishtrahull Island Light-station, the parcel having just caught the weekly post-boat returning from Malin Head to the island. I was delighted to find that the bird was in an excellent state of preservation for skinning and dissecting. It had been dipped in spirit * before being posted, a wise procedure on the part of Mr. Glanville. For the epidermis was thereby toughened and prevented from peeling, a mishap well known by the taxidermist to occur in some cases within twenty-four hours if the weather

* Immersing a specimen in spirit for a few hours or even less before posting it is a good practice in warm weather. Fat birds, as this one was, are improved by this treatment.

be warm. I found no difficulty in making a first-class skin of the bird, which, with other avian rarities collected by me, will, in due course, be presented to the National Museum, Dublin.

An examination of the body afforded evidence that the bird was quite fresh when picked up, and was more than likely killed by striking the lantern during the previous hours of darkness. From the nature of the wounds, involving not only severe lesions of the skull and brain, but also fracture of the sternum and intra-thoracic haemorrhage, death was evidently instantaneous, and the bird, immediately on striking the lantern, no doubt fell over the balcony down on to the rock. A tract of feathers, extending along the left cheek and left side of the neck, was knocked out, indicating that the bird did not collide of necessity head on, but much more likely was carried sideways or obliquely against some part of the lantern.*

The condition of the body was very good, the muscles were well developed, and much fat was present. The specimen weighed three drams, thirteen grains, being proportionately as heavy as were any well-nourished Sedge-Warblers which I have obtained on their regular migrations past the Tuskar Light-station.

From the foregoing facts it is obvious that we cannot place this bird in the category of a waif which had been perambulating about on the rock in a half-starved condition for some days before death overtook it and rid it of its miseries.† In other words, it was not a bird which, becoming separated from its companions, drifted about aimlessly until, fatigued or storm-bound,‡ it sought refuge on a rock. The bird seems to have

* By the term lantern I include all the parts besides the glass, *e. g.* hand-rails, ladder, dome, balcony-rails, &c. On the different ways birds strike the lantern, see my papers on "Grasshopper-Warblers on Migration" ("Irish Naturalist," August, 1912, p. 140); "Spotted Flycatchers on Migration" (*ibid.* p. 197); "Diurnal Migrations" ("Zoologist," 1913, pp. 217, 218, 219).

† On the other hand, an Icterine Warbler which I have recently obtained from the Tuskar Rock comes under this category.

‡ As a matter of fact, at the time that this Aquatic Warbler was picked up, and during the previous hours of darkness, the wind, coming from the west, only blew with the force of a gentle breeze, *i. e.* force 3, as registered on the Beaufort scale. The weather condition was cloudy, with passing showers.

travelled with several other species which habitually visit the Tuskar on migration, including its close ally the Sedge-Warbler. And it is more than likely that other Aquatic Warblers consorted with it but escaped detection,* either because they did not strike the lantern, or, if they did, they fell into the sea, or on to an inaccessible part of the rock or where it is covered by the tide at high water, where they would soon be swept away, instead of falling on an accessible area of the rock where they would remain until the lightkeeper found them and picked them up. Although only one other bird was obtained on the same date, namely, a Wheatear, which struck the lantern at 2.30 a.m., nevertheless, I learn in a letter from Mr. Glanville, written on the morning he obtained the Aquatic Warbler (August 9th), that "there are birds at the lantern every night, but as weather is clear very few are striking." To substantiate the evidence that birds about this time were on the move at Tuskar he sent me: Willow-Warbler, found dead on the rock on August 6th and 8th; Sedge-Warbler, ditto, August 7th and 8th; a Wheatear, ditto, August 8th; also Wheatears which struck the lantern on August 7th and 8th. In regard to identification Mr. Glanville exercised due caution in not attempting to put a name on the bird offhand. This is what one would expect, for he had a very brief period in which to examine it before posting it, few specimens with which to compare it, and very little literature to consult. To add to this he was particularly busy preparing to go ashore himself that morning. Albeit he discriminated at once that the bird was no ordinary Sedge-Warbler, not only on account of the characteristic and conspicuous buff stripe running along the middle of the crown of the head, which many ornithologists lay so much emphasis upon as though it were the only distinguishing mark between the Aquatic and Sedge-Warbler, but also because the pattern of the plumage

* I have cumulative evidence to show that rare as well as common birds are apt to visit light-stations on migration in the plural even more than in the singular number; witness occurrence of Tree-Pipits at Tuskar Rock in September, 1913 ('Irish Naturalist,' November, 1913, p. 220), and of Reed-Warbler in September, 1912 (*ibid.* March, 1912, p. 50). *Vide* also remarks in my article on "Grasshopper-Warbler on Migration" ('Irish Naturalist,' August, 1912, p. 139). Indeed, the term *rare* is often more applicable to the periodical than to the numerical status of many species.

was different on the back and tail, and the colour of the legs was different. To quote Mr. Glanville's own words, he writes : " What do you think of the Sedge with spots on the breast (referring to an immature Sedge-Warbler sent with particularly well-marked spots on the breast), also the one found dead on the rock on the morning of the 9th, with head marked different to the rest, also spots on back and tail different, and legs and feet more flesh-coloured ? " Having dried the bird and arranged its feathers, I was at once struck with the difference in the plumage not only of the crown of the head but of the rest of the upper parts, including the upper tail-coverts and rectrices (long tail feathers). In this immature Aquatic Warbler the markings of black and buff on the back are bolder and more clearly defined than on the immature Sedge-Warbler.* The buff is lighter and clearer, and the dark streaks more closely approach a black shade than in the Sedge-Warbler. In the latter the dark parts of the feathers are more mud-brown in colour. With the feathers lying in their proper position the bold striping of black and buff gives the back a somewhat " tiger-like " pattern of plumage, which is not apparent in the plumage markings of the Sedge-Warbler. In the Sedge-Warbler the buff and brownish markings of the back become ill-defined, and in some specimens the lower back feathers and upper tail-coverts merge into a brownish monotone; in the Aquatic Warbler the striped pattern in these regions is well maintained though not so boldly displayed as it is higher up on the back. In the Sedge-Warbler *all* the rectrices are dusky in colour with a mere thin trace of buff edgings; in the Aquatic Warbler both webs of the *central pair of rectrices* are broadly margined with buff, so that the median clear dark streaks which extend the whole length of the shaft are conspicuous; the rectrices of the Aquatic Warbler are also longer, narrower, and more acuminate than those of the Sedge-Warbler. The wings, however, of both species are remarkably alike †; but the purity in tone of the dark and buff markings is seen to advantage in

* In the mature Sedge-Warbler, especially in nuptial garb, these markings on the back are much less defined.

† For this reason Sedge-Warbler should be sent entire for identification. It is a bad practice to send a wing or a wing and a leg only.

the Aquatic Warbler. In both species the bastard primary is very small, while the third primary is the longest and shows emargination of the lower end of the outer web. The length of the wing, measured from the carpal joint to the extremity of the longest flight feather, corresponds to the average wing-length of the Sedge-Warbler. Compared with a number of Sedge-Warbblers, I found that the beak was a shade shorter and a trifle more robust at the base. The colour appears to be the same in both species, *e. g.* upper segment and distal half of lower segment dark brown, proximal half of lower segment horn-brown. The feet and toes, much the same length in both species, are lighter in shade in the Aquatic Warbler and exhibit a light flesh tint; in the Sedge-Warbler the shade is horn-brown.

So much then for the external distinguishing characters in the two species. As already mentioned, it is the broad buff stripe running in a sagittal direction from beak to occiput which ornithologists seem to have paid most attention to, and have at the same time taken little account of the difference of the rest of the plumage. Saunders, for instance, in his 'Manual,' states that "the conspicuous buff streak down the middle of the crown in the Aquatic Warbler is an unfailing mark of distinction between this species and the Sedge-Warbler." In the description of the rest of the plumage no differentiating points are mentioned. Mr. Witherby and Dr. Ticehurst, writing on the occurrence of Aquatic Warblers since Saunders's book was published (2nd edition), 1899, say: "The Aquatic is much like the Sedge-Warbler in general appearance, but the broad buff line down the centre of the crown distinguishes it at once when seen in close quarters."* Mr. Barrington, writing on the only other Aquatic Warbler obtained in Ireland, says: "The buff stripe along the centre of the head, with a darker stripe at either side, which is separated again from a brighter stripe from the eye, sufficiently distinguishes this bird from its nearest ally the Sedge-Warbler."† Now, while the broad medial buff stripe is markedly conspicuous in the head of the Aquatic Warbler, and normally is not found developed to such an extent in the

* "On the more Important Addition to our Knowledge of British Birds since 1899." 'British Birds,' vol. i. p. 85.

† 'Irish Naturalist,' vol. xii., November, 1903, p. 300.

head of the Sedge-Warbler, a careful inspection of the latter species when immature shows it is present; furthermore, the black stripe immediately above the buff-coloured eye-stripe (superciliary stripe) is practically as well marked as in the Aquatic Warbler. This black stripe is also present in the head of the adult Sedge-Warbler in spring and autumn garb, but as the lighter markings of the crown of the head are considerably darker than in the immature bird, this dark stripe is much less conspicuous. All the same, it is quite definite. Hence this stripe and the lighter eye-stripe form no absolutely distinguishing character of the Aquatic Warbler. The black stripe in the Aquatic Warbler's head looks more conspicuous because the buff stripe is broad, light, and clear in colour, and forms a stronger contrast than do the markings on the crown of the head in the Sedge-Warbler.

If one were to examine quite casually the crown of the head of an immature Sedge-Warbler when the feathers were not lying absolutely in their proper position, one might get the impression that the head was speckled or at the most irregularly streaked with buff and brownish black markings. Such, however, does not represent the true pattern of the head plumage as it exists in life, or in the dead bird when the feathers are carefully re-arranged. In reality the plumage pattern of the head in the Sedge-Warbler (best seen in the immature bird) is made up of a narrow medial buff stripe, on either side of which are narrow alternating dark and light stripes, longitudinally directed, and disposed in a bilaterally symmetrical manner. The essentials of this pattern appear to be represented also in the head of the Aquatic Warbler, but while the stripes are of almost equal thickness in the Sedge-Warbler, we find that one of the buff stripes is remarkably thick and another is extremely thin in the case of the Aquatic Warbler. The thin, hair-like buff streak separates the broad black streak immediately over the buff eye-streak into two black bands, both of which are present in the head of the Sedge-Warbler and are separated by a stripe of buff. In the head of the Sedge-Warbler and in that of the Aquatic Warbler we find markings which, for the purpose of description, I propose to designate as follows:—A stripe of buff running along the

middle line of the crown from beak to occiput, *the medial buff line*. In the Aquatic Warbler this is very broad and clear yellow-buff in colour. In the immature Sedge-Warbler it is narrow and duller in shade; in the adult Sedge-Warbler it is much duller, and varies from dark buff to dusky brown. On either side of the *medial buff line* are two dark streaks. These may be called the *inner dark lines*. In the Aquatic Warbler they are clearer, darker, of a warmer hue, and broader than in the Sedge-Warbler. On either side of these are two light streaks. These may be called the *outer buff lines*. In the Aquatic Warbler they are exceedingly thin, though of the same colour as the *medial buff line*. In the Sedge-Warbler they are of nearly equal breadth with the *medial buff line* and of the same colour. On either side of the *outer buff lines* are two dark streaks which may be called the *outer dark lines*. Though darker and richer in colour in the Aquatic Warbler, they are of about equal thickness in both species. They lie immediately above the buff superciliary stripe, which is well-marked in both species and calls for no further notice.

Seeing, then, that there is an interesting inter-relation in the plumage pattern of the head in the two species—a pattern consisting essentially of alternating longitudinal buff and blackish streaks—and that the points of distinction are relative and not absolute, variations are not to be altogether unexpected. In a large series of Sedge-Warbblers which I have examined, I have found gradations not only in the shade but in the relative thickness of the buff streaks, leading from the typical head plumage-pattern of the Sedge-Warbler to forms resembling that of the Aquatic Warbler (*vide* fig. 4). And, no doubt, if one could in the same manner go through as large a series of specimens of Aquatic Warblers, one would find variations approaching the head plumage-pattern of the Sedge-Warbler. The above remarks apply in the main to immature birds as they appear in autumn garb, at which season the buff in the head of the Sedge-Warbler is much lighter than in spring. If in the nuptial plumage a variety of Sedge-Warbler were found, in which the medial head streak was broader than usual, resembling in that respect the same streak in the head of the Aquatic Warbler, still, owing to the fact that

the buff of the former is at this season almost smoky brown, and of the latter bright yellow, it is plain that the heads of the two species would be much more distinct than if this variation presented itself in the head of the immature autumn Sedge-Warbler. I have mentioned that the distinguishing characters in the *whole plumage of the Aquatic Warbler*—not only those of the head—should be clearly pointed out. For if one is not well aware of the fact that the two species in immature garb are *quite distinguishable, apart from the head markings*, one is liable to fall into the error of thinking that a Sedge-Warbler, in which the medial buff head line is broad, is an Aquatic Warbler. I must admit that when I first obtained such a specimen of this type (fig. 4), I was not quite sure that I was not in possession of another Aquatic Warbler; all the more so, because its date of capture followed closely on the heels of that of the genuine Aquatic Warbler (fig. 5). However, by carefully comparing the bird with several Aquatic Warblers, in addition to the one obtained on Tuskar, I was able to refer this abnormally plumed Sedge-Warbler to its proper position. My best thanks are due to Dr. Hartert for affording me facilities to examine the fine series at Tring Museum, and also for confirming my opinion as to the species. In connection with this interesting question of variation in the plumage of the head of the Sedge-Warbler, I have selected four birds, together with the Aquatic Warbler from Tuskar, from which I have made photographs. These serve to illustrate:—The dark smoky buff and blackish streaked heads of the nuptial and mature autumn plumages (fig. 1), a dark type of buff and blackish streaked head found in some immature autumn birds (fig. 2), the more usual light buff and blackish streaked head of the immature autumn bird (fig. 3); and a further gradation in which the medial buff streak is conspicuously broad and light in colour (fig. 4); resembling the same in the Aquatic Warbler (fig. 5). Sex appears to play no part in these variations, except that there may be a slight tendency for the buff streaks to be darker in the immature male than in the female. However, it is interesting to note that fig. 4 is a photograph of a *male* immature bird, in which it has been pointed out the buff on the head is dominant and bright. Fig. 3 is a photograph of a female bird with another variation, *viz.* barring of the tail. I have a

male obtained at the same time with exactly the same pattern of head and with tail also barred. Passing on to other points in connection with the examination and dissection of the Aquatic Warbler from Tuskar, I may give the following additional details:—

Total length, 12.7 cm. Wings (right and left same length),* 6.1 cm. Bastard primary, 1 cm. (very small as in the Sedge-Warbler). Tail, 5 cm. Feet, 2.1 cm.; light flesh colour. Toes similar. Beak, .85 cm. Upper segment and distal half of lower segment dark brown; proximal half of lower segment, yellowish brown. Weight, 3 drams, 13 grains. Condition, very good, much fat present. Sex, female. Age, immature. Plumage, first autumn, bright and clean. Gizzard, quite empty.

PREVIOUS OCCURRENCES OF THE AQUATIC WARBLER IN THE BRITISH ISLES.

Turning now to the occurrences of the Aquatic Warbler in the British Isles, we find that there is only one other authentic record from Ireland. This affects a bird which struck the lantern of the Bull Rock, Co. Cork, on September 20th, 1903—that is to say, ten years previous to the capture of my specimen. The bird from the Bull Rock was collected by Mr. Joseph Higginbottam, the light-keeper, who sent it to Mr. Barrington.† It proved to be an immature male. The Aquatic Warbler has, in all likelihood, touched upon the Irish coast on other occasions, but has been overlooked. It is quite possible that among some of the numerous wings chopped off by the lightkeepers and sent to Mr. Barrington, there may have been some which were not distinguished from those of Sedge-Warbblers. This may appear a bold assumption, but I believe that it is worth making in order to show how unsafe it is to rely on the identification of closely allied species (whose wings are marked so very alike), by an examination of a wing, or of a wing and a leg only. And I understand that, until quite recently, Mr. Barrington solicited that, in the case of common birds, only these parts should be

* Both wings should be measured. A pair are not always similar in length.

† "The Aquatic Warbler—a New Irish Bird." 'Irish Naturalist,' vol. xii., November, 1903, p. 309. R. M. Barrington.

sent for purposes of identification. I cannot say that I am in favour of this procedure in regard to any bird, as in addition to what I have pointed out about the wings, much other information which might be gained from an examination of the whole bird in the flesh is thereby lost; certainly entire Sedge-Warblers should be examined.

The occurrences of this species in Great Britain have not been many, and may be summarised as follows:—One obtained in Sussex on October 19th, 1853, and first recognised by Newton. One obtained at Loughborough, Leicestershire, in the summer of 1864. One obtained near Dover in 1871. One obtained in Norfolk in September, 1896. The above instances are taken from Saunders's 'Manual of British Birds,' 2nd edition, 1899, p. 87. The same author also mentions that the Aquatic Warbler, figured in Hunt's 'British Ornithology,' is of a specimen probably obtained in Norfolk in 1815.

The following occurrences were recorded after the publication of Saunders's 'Manual,' together with a few omitted by that author:—One obtained in Hampshire, September, 1876; another September 20th, 1897; one obtained at St. Catherine's Lighthouse, Isle of Wight, September 29th, 1905; one seen September 7th, 1897, in Sussex; two obtained in same county, August 8th and 11th, 1902; and one obtained and others seen on August 18th, 1905. One was obtained in Norfolk on September 9th, 1902; a second seen on September 19th, 1903; and a third seen on September 15th, 1904. The above instances are given by Mr. Witherby and Dr. Ticehurst in 'British Birds,' vol. i. p. 85, in a paper entitled, "On the more Important Additions to our Knowledge of British Birds since 1899." Further notices of the occurrence of the Aquatic Warbler in Great Britain are as follows:—One killed at Eddystone Lighthouse, Cornwall, October 11th, 1907 (C. B. Ticehurst, 'British Birds,' vol. ii. p. 28); one obtained at Eastbourne, Sussex, on October 7th, 1908 (E. C. Arnold, 'British Birds,' vol. ii. p. 236).* One obtained at St. Catherine's Lighthouse,

* A good drawing of this bird is made; but I think that the dark shafts and middle portions and lighter edges of the rectrices are not brought out enough, and the upper tail-coverts are too grey, but the dark and light stripes of the back are faithfully depicted.

Isle of Wight, on the night of September 17th-18th, 1909 (H. F. Witherby, 'British Birds,' vol. v. p. 176); one (a male) obtained at Norfolk, on October 23rd, 1912 (Clifford Borrer, 'British Birds,' vol. vi. p. 220); one (a male) obtained at St. Catherine's Lighthouse, Isle of Wight, on August 17th, 1912 (A. M. C. Nicholl, 'British Birds,' vol. vi. p. 344).

It may be seen from the above statistics that, omitting the birds seen but not obtained, there have been procured during the last ninety-eight years seventeen specimens in Great Britain (England) and two in Ireland. The first in Norfolk in 1815. The last to date on Tuskar Rock, Co. Wexford, on August 9th, 1913. It is, no doubt, right to regard the Aquatic Warbler as a rare British bird, but its much greater rarity as disclosed by the earlier records has been apparent rather than real. Not only was the bird confounded with the Sedge-Warbler and specimens left unidentified for years—while probably others from time to time passed out of the hands of museums and private collections as Sedge-Warblers, to make room for valuable specimens—but also owing to the lack of observers at light-stations, many specimens, killed or captured striking, were never procured. A view of the records which I have summarised show this clearly to be the case, for, with additions in the number of workers on the subject of bird-migration at light-stations, and through the co-operation and increasing vigilance of the light-keepers, we find that an increase in the number of records of rare birds touching our coastlands have come to hand. Two noteworthy instances of birds whose numerical and periodical status as migrants to Ireland have undergone marked change, *pari passu*, with our growth of knowledge on migration are to be found in the case of the Pied Flycatcher and the White Wagtail. When A. G. More—one of the greatest living authorities on Irish birds of his day—published his 'List of Irish Birds' for the Science and Art Museum, Dublin, 2nd edition, in 1890, the two species just mentioned were designated as *very rare visitors*. At the present time I should regard the Pied Flycatcher as a rather scarce and irregular visitor, chiefly in autumn, while the White Wagtail I should certainly designate as a plentiful spring and autumn migrant. In the same manner other species might be cited.

GENERAL GEOGRAPHICAL DISTRIBUTION.

Regarding the general geographical distribution of the Aquatic Warbler, Saunders details it as follows:—"The Aquatic Warbler seldom visits Heligoland; though it breeds sparingly in the southern parts of Denmark, Schleswig-Holstein, and on the southern side of the Baltic. In Holland and Belgium it is of rare occurrence; but in France it is found annually in the departments of the Somme and Nord. In the Brenne and beyond the Loire it arrives about the third week in April to breed; while further south in the Camargue, and similar marshy districts, it is not uncommon. Eastward it is fairly distributed throughout Germany, becoming abundant in Silesia, as well as in some parts of Poland, and only less so in Austria-Hungary. It breeds in many parts of Italy, Sicily and Sardinia, but in the Spanish Peninsula I have obtained it only in September. In North Africa it is probably resident. In the eastern portion of the basin of the Mediterranean it appears to be only a migrant or a winter-visitor, and the marshes of the Southern Ural form its boundary in that direction." * In conclusion, it may be noted that while the Aquatic Warbler is a species whose fly lines on migration appear to lie east and somewhat south of our isles, it nevertheless reaches and breeds in as high latitudes, *e.g.* Denmark and Schleswig-Holstein. And so we may expect to find it extending its flight westward, and turning up at light-stations with increasing frequency, as the workers on bird-migration go on adding to their numbers, and the light-keepers become more and more vigilant, and learn to discriminate better between common and rare birds.

EXPLANATION OF PLATE.

Fig. 1.—Sedge-Warbler. Adult male, showing dark smoky buff and blackish streaks on head. Fig. 2.—Sedge-Warbler. Immature male, showing dark type of buff and blackish streaks on head. Fig. 3.—Sedge-Warbler. Immature female, showing light type of buff and blackish streaks on head. Fig. 4.—Sedge-Warbler. Immature male, showing broad buff line on head, simulating plumage pattern on head of Aquatic Warbler. Fig. 5.—Aquatic Warbler. Immature female, showing broad medial buff line on head.

* 'Manual of British Birds,' second edition, 1899, p. 88.

SOME ORNITHOLOGICAL WAR-NOTES FROM GREAT YARMOUTH.

By A. H. PATTERSON.

SURELY others of your contributors besides myself have noticed unusual doings or movements among our wild birds as a result of the unrestfulness attending the noise and turmoil of the great war? The recent nocturnal visit of Zeppelins, I understand, sadly upset the Norfolk Pheasants, which crowed loudly their fright and annoyance at the unusual disturbance. Taken generally, I am inclined to think the remarkable scarcity of our usual winter visitors has been greatly due to the war—I speak now for my own neighbourhood—and I am somewhat of an opinion that the migrant hosts, in general, proceeded further southward. I certainly discovered fewer small birds washed up at the tide-mark during the period of the autumnal migration, a fact, perhaps, due to the removal of light-vessels and the suppression of coast lights, in comparison with what I have noted in other years. We also had fewer thick nights than normally, with much rain, and a remarkable insistence of winds from the south and westward. Then, too, we had very little ice and snow before Christmas; and, again, the old Breydoners' axiom that "No snow here afore Chris'mas—little fowl arterwards," would seem to have contained some truth in it.

As I remarked in the 'Zoologist' (1914, p. 392) early in the war, I noticed some inrushes of Starlings, probably birds ousted from the Flanders marshes; and the erratic incoming of scattered flocks of Gulls from the North Sea, their wild, tumbling, scared movements synchronising with reported encounters at sea. Huge flocks of various Gulls, on some occasions probably mustering 10,000 birds, were to be seen on Breydon in August during the early days of the war; there they must have played unprecedented havoc among the Shore Crabs (*Carcinus mænas*) as the days went by; and scarce enough became the carrion

(dead Dogs and Cats) that occasionally came to the surface in decaying sacks, or when the gas-inflated carcasses came to the surface in defiance of bricks or stones attached to them: all carrion drifted to the "ronds" (saltings) was speedily skeletonized. This "gull-hunger" increased as the war proceeded and developed, and the great autumnal Herring fishery of the East Coast dwindled to small proportions, and finally to vanishing point. I need hardly repeat my remarks on the sad pass these interesting birds were brought to (*vide 'Zoologist,' Jan., 1915, pp. 14-15*) when the Herrings became scarce. In ordinary seasons the great numbers of Gulls that work southward to this neighbourhood find, as a rule, plenty of washed-up Herrings, with stale Mackerel, dead Weavers, Scads (Horse-Mackerel), Dog-fishes, and small Whitings, which have either dropped out of the herring-nets after being enmeshed, or have been thrown back into the sea by the fishermen when "scudding" (cleaning and clearing) their nets when coming home from the fishing grounds, or that have been dropped in the river and carried out on the ebb, and thrown up afterwards on the sands at the harbour-mouth by the flood-tide.

Day by day the hungry birds swarmed to the sands, just north of the Gorleston Pier, and stood about listlessly but with evident watchfulness for any small mercy in the shape of broken Herring, or any other edible, thrown shorewards by the waves, on sight of which a great commotion followed, with a screaming chorus of disputation and the fluttering of a thousand wings. On some days, I am confident, many a bird "went supperless to bed"—a cold one at that, on mudflat and flooded marsh. That new departure—their frequenting of the fish-wharf and the roosting on the top of gutting- and curing-sheds—was a novelty as far as Yarmouth and Gorleston are concerned, although for a year or two previously, on scarce days, the various big Gulls ("Greys," and adult Saddlebacks, and Herring-Gulls) had begun to perch upon the tops of the pyramids of empty and full barrels. The sight of "swills" of Herrings on the wharf, and the "troughs" of fish in the pickling-yards tempted them to the busier haunts of men, and the pity shown them by the fishing fraternity, coupled with a certain immunity from molestation, reassured them. For a number of days broken fish was thrown

to them, and their agility of seizure and exploitation much interested and entertained the onlookers. That a Gull can go days without food I am assured; a gunner brought to me a grand-plumaged old Greater Black-backed Gull from Breydon; evidently he had given it a "body shot," but as it appeared to promise it, I gave it a chance of recovery. For over a week he looked at, but entirely refused, every tempting morsel—sliced Herring, milt, &c., contenting himself with a sip now and then at the tank in my small aviary. On the seventh day I found him dead. It may seem to have been a cruel experiment, but I did my best for him.

The small Gulls (Common and Blackheads) very speedily gave up the contest on the foreshore, the former going away altogether, the latter haunting the river, where scraps from the drains and from various vessels were thrown overboard. Later on, when the fishing had come to an end, and the marshes stretching from Yarmouth to Norwich, and Beccles and the Broadlands, became considerably flooded, owing to continuous rains, the Gulls spread themselves around for many miles, the larger ones undoubtedly in quest of drowned-out Field Mice and Water Voles; and the smaller ones in search of the plentiful supplies of Earthworms and larvæ (that of the *Tipula*, in particular), which kept them going some time. The Lapwings from the uplands and further northward also joined them in their search for the smaller prey. I may venture, I think, to prophesy a scarcity of that grass pest, the "leather-jacket" (*Tipula* larva) during the coming months. Of late the larger Gulls have become scarce, their instincts, and, mayhap, memories having taken them northward again to wait on the Scotch Herring fishers; and may they fall on better days!

I might here add that at about Christmas time a number of large Gulls discovered a big deposit of "salt and scales" (a valuable waste product bought up by manure merchants, which are the sweepings from the herring-boats and fish-houses) that also contained broken Herrings and entrails, and they speedily made inroads upon the heaps. It was only by the flinging over of a foot-deep layer of more salt that the birds were kept off; even then I observed here and there, as did the owner, a gap made by hungry birds, and the fish-refuse got at. To me it is

remarkable that a sea-bird should be able to swallow so much salt, or even to satisfy its thirst by sipping sea-water!

After a time some birds get somewhat accustomed to strange sights and sounds ; and notwithstanding the great bewailing of the old Breydoners over the increase of railway unrest—that “it would drive away all the fowl”—the fowl they mostly referred to (the Wigeon) still haunt Breydon in spring, often in some numbers, hardly troubling to rise on the wing at the rumbling by of a train, a few hundred feet across the north-west wall. The Gulls, that were at first sadly put about and scared by the earlier aeroplanes that came hovering over the flats like huge Hawks, now pay little heed to them ; and I was much interested in seeing a swarm of Gulls following up a fishing-boat to the harbour on that morning, when, half an hour before, the guns of the German cruisers had been booming discordantly in the Roadstead.

In the middle of October a beach gunner informed me that he had seen several very dirty-looking Guillemots and Razorbills in the breakers, which seemed more or less unable to fly, or to swim with anything like their usual ease. One or two had been tumbled ashore on the easterly wind. I at once turned to the south beach, where, in the course of a mile, I found a dead Razorbill at the tide-mark, its white under parts soiled as with tar or black varnish ; the wing-feathers were bedaubed and sticky, many of those on both wings adhering to each other. A miserable Razorbill feebly struggled in the surf, and in a few minutes was tumbled ashore, but on each attempt to stalk it, it wobbled, seal-like, down the wash and dived under an incoming breaker. Once again it came ashore, scrambling up to the tide-mark, when I threw a stone at it, mercifully stunning and killing it ; it, too, was besmirched with the stuff, which might have been petrol ; but whatever it was, it had dried rapidly on the plumage.

Quite a number of others came ashore between Caister and Corton, all more or less bedraggled. I suspect that some unfortunate submarine or destroyer had been sunk, and the liquid had, after an explosion, come to the surface. Not long before this our navy had destroyed enemy boats in the North Sea in a locality frequented by these birds. Mr. F. C. Cook, of Lowestoft,

made some observations in his neighbourhood ; and he assured me parts of the beach at Corton had become quite black and tarry, a condition very soon obliterated by drifting sand.

One live Razorbill brought me, that was rather cleaner than the general run of the birds, with a Guillemot, was placed in my small aviary ; the former died after a day or two's incarceration, vicious and irritable to the end. The Guillemot, that probably had not been quite so pounded by the waves, lived several days longer, became tame enough to feed from my hand, and would utter a throaty croak of satisfaction when I scratched the top of his head. I have never been successful in keeping either of this species alive for long, as I have the Cormorant, Shag, Gannet, and some others, nor do I think the first two species ever prove satisfactory livers, even if taken unhurt from their native cliffs.

On October 29th I walked along the beach to Hopton, on the Suffolk coast, finding the high-water mark bestrewn with the moulted feathers of the larger Gulls. On most of them were dry spots and splashes of the offending liquid ; evidently the Gulls had been freely sprinkled with polluted sea-spray, but being of a more restless and suspicious nature had wisely betaken themselves to less unpleasant quarters. A fisherman assured me that on one occasion the crew of a herring-boat could not shoot their nets "for the tar on the surface—the sea bein' black all around, and smudgered with it."

It was reported in a local paper that (late in January) when the German cruiser 'Bluecher' sank in the North Sea, mingled with the human beings struggling for existence were arms, legs, and clothing, with thousands of dead fish (undoubtedly killed by explosions) ; to the latter the Sea-Gulls flocked to enjoy a feast such as had not come in their way for many a day, thus proving that their appetites had very speedily overcome their apprehensions.

THE PHARYNGEAL TEETH OF FISHES.

By COLONEL C. E. SHEPHERD (Indian Army).

(Continued from vol. xviii. p. 272.)

SYMBRANCHIDÆ.

Amphipnous cuchia is an Indian fish that is provided with respiratory air-sacs, enabling it to breathe when buried in the mud of dried-up swamps, or lying amidst the weeds at the sides of tanks. It has no gill-rakers, and only three branchial arches. The upper pharyngeal teeth are in a circular group on the head of the third epibranchial; they are so much embedded in mucous membrane as not to be easily seen, but are quite palpable to the touch if a finger-tip is pressed against them. In a similar way cognisance can be taken of the existence of the lower pharyngeal teeth.

FIERASFERIDÆ.

Fierasfer acus has three big, horny gill-rakers which stand up on the first cerato-hypobranchial arch; the one at the angle being contained about two and a half times in the length from the angle to the end of the hypobranchial: there are three tubercle gill-rakers on the first epibranchial. The other arches are furnished with tubercle gill-rakers. The upper and lower pharyngeal teeth are minute, and in each case grow in elongated groups. These fishes have a curious habit of spending part of their lives, possibly for shelter, in the interior of Sea-Slugs (Holothurians), and also in bivalve Mollusca.

SCOMBRESOCIDÆ.

Belone acus is a Mediterranean fish, similar to the "Gar-Pike" of the English coasts. The upper pharyngeal teeth are in two distinct groups on each side; the upper group, long and narrow, has villiform teeth; a row of these along the inner margin stand out. The lower group is triangular in shape with a pointed apex and rounded base; it has villiform teeth. The lower pharyngeal teeth are in one long triangular

group of villiform teeth, occupying the whole floor of the gullet. The lower pharyngeal bones are united.

AMMODYTIDÆ.

Ammodytes lanceolatus, the Greater Launce, also called the "Greater Sand Eel," has nineteen long, horny gill-rakers on the first branchial arch, cerato-hypobranchial portion ; the length of the longest equals the depth of the gill-laminae below it; there are four on the epibranchial. The second and third arches have similar but shorter gill-rakers on their outer sides, whilst on the fourth arch they are shorter still. The upper and lower pharyngeal teeth are very minute, barely but just palpable to the touch ; under the microscope they show as cardiform teeth.

ATHERINIDÆ.

Atherinichthys argentinense, called the "Pajerry" at Buenos Aires, has thirty-three long horny gill-rakers on the first cerato-hypobranchial arch, with nine on the epibranchial. They all carry teeth. The first thirteen along the cerato portion counting from the angle have their tips turned backwards, as also are the tips of the first two on the epibranchial. The length of the longest gill-raker is equal to the depth of the gill-laminae below it. The inside of the first arch, and both sides of the second, third, and fourth arches all carry numerous short horny gill-rakers bristling with teeth ; these gill-rakers fit closely between themselves and form a very good filter. The upper pharyngeal teeth consist of a long narrow group of minute cardiform teeth on the limb of the third epibranchial, and two long, narrow, roughly elliptical shields on each of the heads of the third and fourth epibranchials, bearing strong conical teeth in the upper half of the shield, with rather smaller conical teeth in the lower half. The lower pharyngeal teeth are in two elongated groups with strong conical teeth at the back part, those in the front part being smaller. There is a marked division in the middle line between the two sets. There is a small group forming four sets of minute teeth, each set apart, at the junction of the second and third hypobranchials with the basibranchials, and also one group stretching across the basibranchials at the junction of the third and fourth arches. (Fig. I.)

Atherinichthys bonarensis, the Sea Pajerry, also from Buenos Aires, has twenty-two long horny gill-rakers on the first cerato-hypobranchial arch, with six on its epibranchial. They all carry teeth ; the longest gill-raker equals in length the depth of

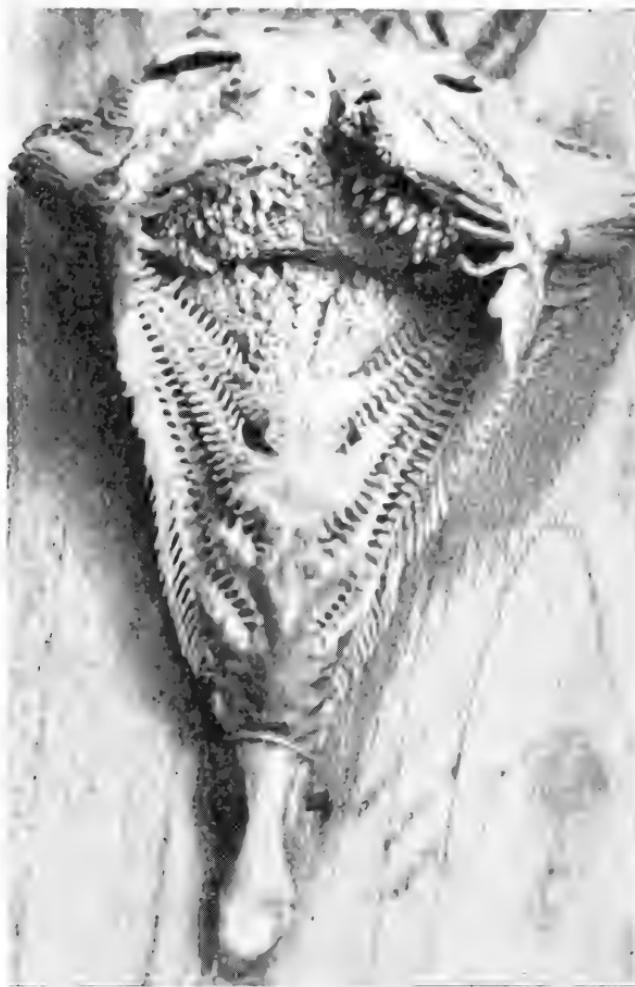


FIG. I.—ATHERINICHTHYS ARGENTINENSE.

the gill-laminae below it. The inside of the first and both sides of the other gill-bearing arches have numerous short gill-rakers bristling with teeth ; these gill-rakers fit very closely together. The upper and lower pharyngeal teeth are similar to those of the last described fish.

POLYNEMIDÆ.

Polynemus tetradactylus is known and appreciated as a table fish in Calcutta as the "Mangoe Fish," and also as the "Tapsi Machli," the latter being its native name. It has seven long horny gill-rakers on the first cerato-hypobranchial arch, with five on the epibranchial. The longest equals the depth of the gill-laminæ below it. These gill-rakers all carry teeth. The inside of the first arch has only three short horny gill-rakers. The second and third arches have small flat tubercles for gill-rakers, but only on the cerato portion, and on both sides of these arches. The fourth arch has a few similar but even smaller tubercles on its outer side only. The whole surface of these arches, tubercles and all, is covered with minute villiform teeth, which extend also to the surface of the basibranchials and on to the tongue. The upper pharyngeal teeth consist of a small elongated group on the upper portion of each of the first epibranchials, also a longer group on the heads of each of the second epibranchials, with minute teeth extending along the rest of the limb; a triangular group on the heads of the third epibranchials, with teeth also extending down the limb, and an irregularly shaped group, square at the top and rounded at its lower part, on the heads of the fourth epibranchials; below this last group, separate from it but still on the fourth epibranchial, is a small triangular group. All the teeth on the third and fourth epibranchials are cardiform. The lower pharyngeal teeth are in two elongated groups, on the fifth arch making a broad V in the mouth, but separated at the apex.

OPHIOCEPHALIDÆ.

Ophiocephalus marulius, called the "Murrul" in India, has fourteen tubercle gill-rakers on the first cerato-hypobranchial, with one on the epibranchial of a large size. There are five tubercles behind the angle also, at the base of the accessory breathing apparatus. All the other gill-rakers are also tubercle-shaped; they fit closely into one another and form a good filter. The tubercles all carry minute teeth. The upper pharyngeal teeth consist of a narrow group on the head of the second epibranchial, of minute cardiform teeth, and a fairly large group on the heads of the third and fourth epibranchials,

of conical teeth, with many of a larger size standing up amongst them. The lower pharyngeal teeth are in a group extending across the mouth in an open V-shape of similar teeth. A circular group of teeth is also apparent on each side of the junction of the third hypo- with the basibranchials. There is an elongate group of minute cardiform teeth on the parasphenoid; the right half of this is shown on the left side of the illustration.

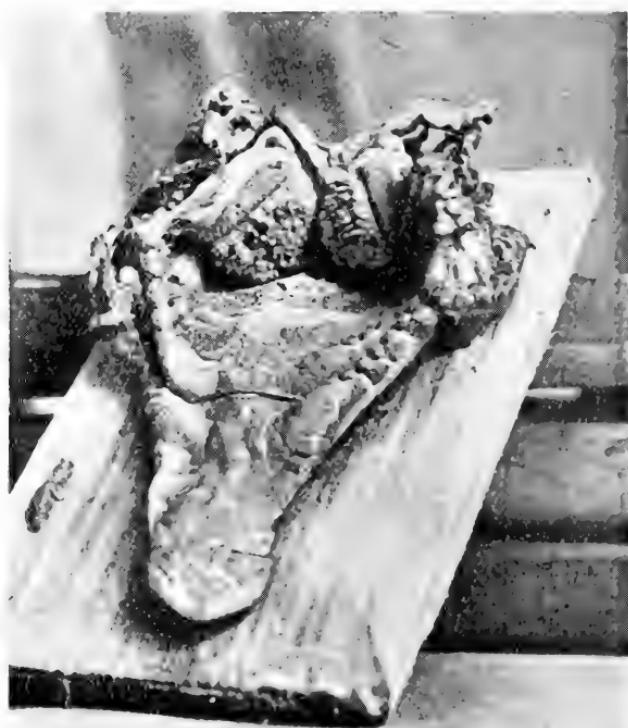


FIG. II.—*OPHIOCEPHALUS MARILIUS.*

(Fig. II.) Incidentally it may be noted that the figure shows part of the accessory branchial apparatus. This fish lives buried in the mud of dried-up tanks and swamps during a long period of dry weather; respiration is carried on by this apparatus from atmospheric air. To show the upper pharyngeal teeth clearly, the roof of the gullet has been pulled forcibly backwards, throwing the branchial apparatus out of its proper

place, which is behind the epibranchials. As seen in the illustration, it looks like a piece of shelled walnut, at the upper right-hand corner.

ANABANTIDÆ.

Anabas scandens, the "Climbing Perch" of India, is another fish provided with accessory branchial apparatus enabling it to live a long time out of water, breathing atmospheric air direct. At the angle of the first branchial arch, and from thence along the cerato-branchial, there is a broad piece of cartilage that engages against a similar piece of cartilage on the first epibranchial. Beyond the cartilage on the first arch there are eight gill-rakers, the first three or four being of fair size, the remainder very small. On the other arches the gill-rakers are all small and tubercular. The upper pharyngeal teeth are strong cardiform teeth in two circular groups. The lining membrane of the mouth above the upper pharyngeal teeth has prominent papillæ. The lower pharyngeal teeth show as one broad patch across the floor of the mouth, with round-topped teeth deeply embedded in mucous membrane.

MACRURIDÆ.

Macrurus armatus, a deep-sea fish, has nine upstanding tubercle-like gill-rakers on the first cerato-hypobranchial arch; these all carry teeth standing well out on the summits of the tubercles. The longest of these tubercles is about three-fourths of the depth of the gill-laminæ below it. The above gill-rakers are on the upper surface of the cerato-hypobranchial; there are five smaller tubercles, that also carry teeth, on the outer surface, but none on the inner. The second and third arches have toothed tubercle gill-rakers on each side; the fourth arch has them on the outside only. The teeth in the tubercles vary in number from four to eight or ten. The upper pharyngeal teeth consist of a little group on the limb of the third epibranchial, of cardiform teeth, and two circular groups on the heads of the third and fourth epibranchials. The lower teeth in these groups are much stronger than those in the upper portion of the group. The lower pharyngeal teeth are in two triangular-shaped portions touching one another along one side so as to form a broad V in the mouth.

Macrurus investigatoris, a deep-sea fish from the Indian

Ocean, got at 446 fathoms (2676 ft.), has no gill-rakers on the outer side of the first arch; a piece of membranous skin is fastened to it and to the side of the mouth, and there is a slit opening between the skin and the arch. The inner side of this arch has small tubercles for gill-rakers. There are ten up-standing tubercle gill-rakers on the outside of the second arch, with smaller ones on the inside. Both sides of the third and the outside of the fourth arch have similar tubercle gill-rakers. They all fit into each other fairly closely, and they all carry needle-point-like teeth. A large group of cardiform teeth on the heads of the third and fourth epibranchials form the upper pharyngeal teeth. The lower pharyngeal teeth form a V-shape on the floor of the gullet. On the head of the second epibranchial there is a small patch of well-marked papillæ.

Bathygadus furvescens, a deep-sea fish from the Indian Ocean, got at 555 fathoms (3330 ft.), has twenty long horny gill-rakers on the first cerato-hypobranchial arch; the longest one, at the angle, being one and a half times the depth of the gill-laminæ below it. There are five similar gill-rakers on the first epibranchial. All the gill-rakers are feebly toothed. On the inside of the first, both sides of the second and third, and the outside of the fourth arch there are short horny gill-rakers. For the upper pharyngeal teeth there is a group on the limb of the third epibranchial of small cardiform teeth, and an oval shield with rather larger cardiform teeth on the head of the same; and a rather large group, but of smaller sized teeth again, on the head of the fourth epibranchial. Two small distinct groups of teeth form the lower pharyngeal teeth.

BERYCIDÆ.

Hoplostethus mediterraneus. The specimen examined came from the Indian Ocean, and was got at a depth of 320 fathoms (1920 ft.). It has fourteen long horny gill-rakers on the cerato-hypo portion of the first branchial arch, with six on the epibranchial. All the gill-rakers are teeth-bearing. The longest one, at the angle, is twice the depth of the gill-laminæ below it in length. On the outside of the second arch the gill-rakers are fairly long, but much shorter than those on the first arch; on the inside of the first and second arches, on both sides of the

third, and on the outside of the fourth arch there are short horny gill-rakers. They do not form a close filter. The upper pharyngeal teeth consist of a short thin line of cardiform teeth on the head of the second epibranchial. A long group of cardiform teeth is fixed to the heads of the third and fourth epibranchials, which terminates upwards in a point at the level of the head of the second epibranchial, and with its lower part swollen out; also a thin line of similar teeth on the limb of the third epibranchial. The lower pharyngeal teeth are in two narrow, elongated groups with a marked division between them.

CENTRARCHIDÆ.

Kuhlia marginata, a fish from New Guinea, has eighteen long horny gill-rakers on the first cerato-hypobranchial. They have teeth. The longest is one and a half times the depth of the gill-laminæ below it. There are six on the epibranchial. The other arches have short outstanding gill-rakers on both sides, as has the inner side of the first arch. They make a good filter. The upper pharyngeal teeth are in two groups; one on the head of the second epibranchial, the other on the heads of the third and fourth. They have small cardiform teeth, the points of which just show through the mucous membrane surrounding them. The lower pharyngeal teeth are smaller.

TOXOTIDÆ.

Toxotes jaculator is a fish from India that has the curious habit of shooting a pellet of water at flies sitting on grass or weed stems overhanging water, and knocking them into the water to be then eaten. The natives of Bengal keep this fish in captivity to watch this curious performance. It has five long horny gill-rakers on the cerato-hypo of the first branchial arch; these are rather widely spread out. There was one soft gill-raker on the first epibranchial's right side, whilst the left side had two. There are no other gill-rakers. The upper pharyngeal teeth consist of a long, fairly large group of minute cardiform teeth on the head of the second epibranchials, and a larger group of similar but stronger teeth on the heads of the third and fourth epibranchials. The lower pharyngeal teeth are on two separate long plates with strong cardiform teeth on the inside edge near the œsophagus, those more forward being smaller.

(To be continued.)

BIRD-NOTES FROM THE MEDITERRANEAN.

By G. BATHURST HONY, M.B.O.U.

DURING the training cruise of 'H.M.S. Cumberland,' in 1911, I spent four months in the Mediterranean, and possibly some notes on the birds seen may be of interest.

We left Plymouth on January 17th, 1911, and our original escort of sea birds soon departed; on the next day, however, we were joined by some Lesser Black-backed Gulls when about one hundred and forty miles from land ($46^{\circ} 26' N$, $7^{\circ} 40' W$). We reached Gibraltar on the 21st, and here I saw some Sand-Martins (the only ones seen during the whole cruise), Blackcaps, a Chiffchaff, and a Black Redstart. The next day I saw a Whitethroat, and put up some Barbary Partridges at the very top of the Rock. The Gulls at Gibraltar were mostly Lesser Black-backed and Black-headed, with a few Herring-Gulls.

We left Gibraltar on February 5th and reached Algiers on the 8th, but though we spent six days there I had little opportunity for bird watching. We were at Malta from February 16th to the 25th, but almost the only birds seen were Maltese Sparrows. We sailed for Alexandria on the 25th, and few birds were seen till about three hours out of Alexandria on the 28th, when a Kestrel joined us and settled on the foremast. I was unable to land till March 3rd, on which day I saw Turtle-Doves, White Wagtails and Spotted Flycatchers. On the 5th, Swallows, Willow-Warblers, Meadow-Pipits and Hoopoes were seen. The Black-headed Gulls were just obtaining their breeding plumage. Leaving Alexandria on the 13th we reached Cyprus the next day, and when some twenty-five miles from the island a party of Wagtails flew round the ship but were not identified. On landing on the 14th I saw Swifts, Swallows, several flocks of Goldfinches, some Hoopoes, Peewits and a Chiffchaff, and the next day a pair of Stonechats.

On the 18th we sailed for Platea (South Greece), which we

reached on the 21st. During our passage among the islands, before reaching Platea, there seemed to be a great scarcity of Gulls, but at Platea itself there were plenty—mainly Herring-Gulls, but with a few Lesser Black-backs and Black-headed. On landing I saw some Jays, and found a Common Buzzard's nest with four eggs situated in the topmost twigs of an oak tree, and I made many attempts to photograph it without much success. However, I spent a good deal of time watching the birds change rounds at the nest and moving about in its vicinity; the female was much the shyer of the two, and would not return to the nest while I was near. One day I saw a Hooded Crow come to the nest with the evident intention of egg stealing, but the owners returned in the nick of time, and he made off, though on another occasion I saw one of them being mobbed by a Hoodie. I once found a small snake (dead) in the nest, but otherwise never saw what the birds fed on. The Hoodies at Platea used to come and feed round the ship with the Gulls, picking up scraps from the water; I do not know if this is a common habit, but I have never seen it elsewhere.*

On the 23rd I saw Magpies, a Hoopoe and a Sparrow-Hawk; and on the 26th a Black Redstart and a Wheatear (sp.?). On the 27th a pair of Ringed Plover arrived and remained a few days when they disappeared, and a pair of Egyptian Vultures were seen in the distance.

On April 1st Swallows arrived in large numbers, and on the same day I found a nest in a hole in a tree made of dry grass and lined with feathers, in which were eight eggs, which I took to belong to a Great Tit; but I did not get a good look at the bird.

On April 3rd we sailed for Venice: during the night there was a strong W. N. W. wind, and I woke up in the morning to see a Swallow sitting at the head of the hammock next to mine. This bird soon died, but another which had arrived during the night was more fortunate. At 7.0 a.m. a small bird, reported to me as a Hedge-Sparrow, joined us, our position at the time being $42^{\circ} 21' N$, $16^{\circ} 30' E$. As we entered Venice on the 5th I saw the first House-Martins of the trip, and after staying five days at

* The Indian House-Crow (*Corvus splendens*) may be seen feeding in this way along the Hooghly and in Colombo Harbour, among the shipping.—ED.

Venice we returned to Platea, arriving on the 12th. The place had absolutely changed, for whereas when we left, less than ten days before, all was bare, now everything was green. There were quantities of Swallows, but otherwise I saw nothing interesting during this visit, and the Buzzard's eggs were not yet hatched.

We left for Malta on the 15th, and the next day—Easter Sunday—was the roughest we had during the whole cruise, with a strong north wind. At 11 a.m. a pair of Purple Herons joined the ship, they seemed very tired and looked as if they wanted to perch, but whenever after much effort they had got into position to do so, they fell right back to leeward, and had to beat up again. They remained with us about two hours, and as they left while I was below, I cannot say in what direction they went. A Wheatear was seen at the same time (position $37^{\circ} 8' N$, $18^{\circ} 3' E$), and during the afternoon a Turtle-Dove left the ship flying north.

Instead of going straight into Valetta, we spent several days to the south of the island, waiting till the weather would permit us to fire our gunlayers' tests. On the 19th a House-Martin joined us, and on the 23rd, while steaming about some eight miles south-west of the island, several Turtle-Doves passed us, and a Blue-headed Wagtail kept with us and occasionally settled—wind N.E. by N. We went round to Valetta on the 24th, and I saw a Whitethroat, a Pied Flycatcher and a Wood-Warbler; the Sparrows had young. The next day the place was crowded with these birds, and in addition I saw a pair of Blackcaps and a Nightingale.

On the 26th the bird catchers had numbers of Blue-headed Wagtails and Meadow-Pipits, which they had caught the day before, and I saw some Collared Flycatchers. At Valetta itself there were no Swallows or Martins, but in the middle of the island on the 27th I saw several. On the 29th the bird catchers had a Golden Oriole.

On April 30th we sailed for Gibraltar, and on the next day a Swallow and Turtle-Dove joined us, our position being $37^{\circ} 15' N$, $10^{\circ} 55' E$, and the wind north-west. We reached Gibraltar on May 4th, and I saw numbers of Swifts, but no Swallows till two days later, and no Martins at all. From Gibraltar we went to Arosa Bay (North Spain), and so back to England.

BIRD-NOTES FOR OXFORD DISTRICT IN 1913
AND 1914.

By H. G. ATTLEE.

February 23rd, 1913.—A Ring-Ousel seen on a fallow with some Fieldfares near Eynsham. This seems very early, but there could be no mistake as to the bird; apart from the white collar, it was both larger and browner-looking than a cock Blackbird, which at one time was close to it. Its movements, too, were different and more like those of a Mistle-Thrush.

May 8th.—A large wader migration over Oxford from 11.45 to 1.15 p.m., the night being very still, damp, and dark. The following recognized:—Dunlin (almost incessantly passing), Knot, Common Sandpiper, and Golden Plover (once); also a note which sounded rather like the “ke-wick” of the Brown Owl, but less loud, and, in fact, between that and the Peewit’s ordinary note; it was certainly neither of those birds, and was quite strange to me. [At the end of July I heard the same cry on the shore near Barmouth, and it came, I think, from two birds which looked like largish waders (or possibly Terns), but I was too far off to see them properly.]

29th.—Flushed a Snipe in boggy ground near Wytham, which looks as if there was a nest near there.

March 11th, 1914.—At Blenheim. A party of some two dozen Tufted Ducks (equal number of each sex about) seen on a quiet part of the water. They allowed a very near approach, but remained mostly merely swimming to and fro, and dived very little.

April 13th.—While watching them, a Great Black-backed Gull passed over quite low down to the north. As it came up towards me over the trees it looked so huge that I took it for a Heron. It was so near that there could be no doubt of its species.

14th, 22nd, and 29th.—I again saw a single large Gull flying

in the same direction near Oxford; but these were too high to be sure of the species—in one case (and probably in the others) it was a Lesser Blackback.

During April the summer birds arrived, rather early in some cases:—Blackcap, 12th; Martin, 13th; Redstarts (several), 13th; Whitethroats (three or four), 14th; Sedge-Warbler, 15th; Lesser Whitethroat, 17th; Reed-Warbler, 19th (by far my earliest record); Swift, 23rd (many, 29th). A pair of Redstarts just outside the town seemed to be already settled at their nest-site on the 19th.

18th.—One Black and three Common Terns at Medley Weir. I first saw the Black Tern beating to and fro over the river, but keeping within a radius of some twenty yards. It kept for the most part some six to ten feet above the surface when working downstream against the wind, occasionally dropping down to, and two or three times momentarily settling on, the water; this evidently in quest of some insect (rather than fish), for it never even dipped its head below water. Its flight, compared with the Common Tern's, seemed lighter and less steady, and more like the Little Tern's. Later it settled on a large stake in the water, and on approaching I then saw the three Common Terns also resting on some other stakes, and all four birds hovered about these for some time, settling, and again flying off. The Common Terns then went farther down river, but the Black one remained and resumed its flying up and down, only moving a little farther off as I approached, till a passing Rook began to mob it, and chivvied it so hotly that the Tern cried out in distress, and, mounting to a considerable height, went right away up the valley out of sight.

A Willow-Wren was already starting to line its nest with feathers by April 26th, and a Chiffchaff's nest was ready for eggs by the 29th.

28th.—Found a nest of the Grey Wagtail in a low stone wall on a secluded part of the Evenlode. The birds went into the hole, and as both remained evidently very anxious close by, uttering their calls, and “balancing” their long tails, I concluded there were young. Just here the stream is so noisy and rapid as to be quite in keeping with these birds, and to recall their typical Welsh haunts. Some week or more later I

was surprised to flush a pair at Godstow Weir, but only saw them this once there.

May 23rd.—I saw what must have been a pair of Sheldrake rising from the neighbourhood of the river near Binsey and flying over the town to the eastward; and on June 11th a single Black-headed Gull was frequenting the river a little higher up.

June 6th.—Two Wrynecks at Sandford—the only ones I've seen in the district. At this date I suppose they must have been nesting here.

October 15th.—Saw what was almost certainly a hen Cirl-Bunting on farm land at Littlemore. As it rose close to me it showed a very distinct greenish rump, and while momentarily perched near looked like a dark-coloured hen Yellowhammer.

17th.—Three Grey Crows on the sewage-farm, Sandford, and a few Bramblings seen near there.

18th.—A Jack-Snipe near Iffley, and a largish flock (some thirty to forty) of small Finches, either Redpolls or Siskins, about trees in Christ Church Meadow.

21st.—Great Tit sang (once or twice about now), and a Chaffinch attempted to sing.

25th.—Swallows and Martins last seen.

26th.—A Quail flushed very close from the hedgebank near Beckley.

November 1st.—Fieldfares first seen.

5th.—A bird I believe to have been a Red-throated Diver (or else one of the Mergansers) flew high over Bagley to the northward (a south-easterly gale at this time); and a Coot seen on Hinksey Reservoir.

7th.—Two or three Coots on river near Eynsham. On the lake at Blenheim found some six Crested Grebes at least, and some Duck with a harsh “kurr”-ing note (probably Pochard). A Heron passed over, and a Green Sandpiper was heard by the lake.

19th.—A Snipe, alarmed by someone on the opposite bank, flew across the river by Sandford Lock, and settled on the bare edge of the water some seven to ten yards in front of me, but unfortunately almost hidden by the overhanging bank. As it came flying over towards me (and for the moment I saw it before it flew) it seemed to me distinctly grey in general hue, so that I

put it down for one of the shore waders, and never thought of it as a Snipe; so grey, in fact, that from this (as well as its size) I expected it would prove to be a Knot (rather than a Dunlin). It came, too, from a bit of bare muddy ground (the only cover being a thin hedge), and when flushed, just flew straight across to me almost! This seems unlike a Snipe, unless it was in a most exhausted condition.

I now tried to get close above it on the bank, but unfortunately it rose just then, and flew back straight over me, so that I could not see the colour of its upper side at all, or, indeed, get any clear view of its colour at all again, as it flew swiftly, and though it flew round two or three times before again settling it did not again come near enough to note this.

It was only now, when flying round, that I saw that it had too long a bill for anything but a Snipe. Its flight was certainly Snipe-like, though, when rising, it did not twist about, nor did it seem so very swift as the Snipe's usual flight is. It uttered no note at all. As a rule, I think, Snipe seem, when flushed once (let alone twice), to go right away; but this bird finally went down on to the island in the backwater only some fifty or sixty yards off. There was a frost that morning, but I think westerly gales just before. Is it possible it could have been *Macrorhamphus griseus*? Though its tameness, &c., might be accounted for in a Common Snipe (though there had been no really hard weather at all), I find it difficult to think that this bird, which looked like a Knot or something of that kind in colour, could be a Common Snipe. This day I again saw a Black-headed Gull over the river.

29th.—A Green Sandpiper flew high over Marston.

Within the last few months I have seen the following varieties near here:—a Sparrow, which appeared to be nearly uniform fawn-colour; a Blackbird with head speckled with white; and a Rook with almost the entire wing-quills white, except, I think, the tips.

NOTES AND QUERIES.

MAMMALIA.

Longevity of Hedgehog.—For some time during the latter part of last century my grandfather had in his possession an English Hedgehog, which attained the age of twenty years. It disappeared one winter; whether it died or escaped to the common is unknown.—(Miss) M. CALLARD (Dulwich).

Distribution of Polecat and of Yellow-necked Mouse.—As I am making enquiries concerning the past and present distribution of the Polecat in this country, I should be grateful to any of your readers who could tell me whether it still occurs in their counties, and, if not, when it was exterminated. I am also trying to work out the distribution of the Yellow-necked Mouse, and should be equally grateful for any information about it.—(Miss) F. PITTR (The Albynes, Bridgnorth).

AVES.

Rare Nesting-site for the Goldfinch.—During the season of 1914 I found a nest of the Goldfinch built in a hazel bush about nine feet up. This I am sure must be a tree rarely selected by this species for nesting purposes. I have found them nesting frequently in yew, lilac, medlar, maple, and fir; uncommonly in laburnum, lime, ivy, and gorse; commonly in chestnut, sycamore, elder, elm, hawthorn, plum, apple, and pear. Can readers add more species of trees to this list? I have heard of nests in the common laurel and the walnut, but I have not yet been fortunate enough to find one in either.—STANLEY LEWIS (Wells, Somerset).

Birds Travelling North in Autumn.—Anent the several notes that have appeared recently in the 'Zoologist' under the above heading, I have had an idea for several years, which is developing into a theory; that is, that with many species of migratory birds (and most species are more or less migratory), these birds, and more particularly the young of the year, work a little northwards of their nesting-places before undertaking the autumnal journey south. Also

that this habit may account chiefly for the fact that almost every species that is extending its breeding range is extending it in a northerly direction. The evidence that I have been able to collect would be difficult to prove with respect to the smaller birds, although it appears to me to be quite apparent. But with some of the larger birds, and more particularly with some of the Terns, I have indisputable evidence that several young birds—on different occasions—have distinctly moved north before taking their long southern journey. I merely throw out the idea at present, as probably other observers will have noticed the same thing.—H. B. BOOTH (Ben Rhydding, Yorks).

Hen Pheasant Transporting Chicks.—On June 9th of last year, at a beautiful and secluded spot on our Somerset moorlands, a gamekeeper and myself on coming up one side of a rhine which divided meadow land from a swampy wood of birch and sallow, walked or rather intruded suddenly upon a female Pheasant. Her immediate behaviour on being discovered was apparent agitation, for she quickly ran round and round in a small circle with wings nearly extended and clucking excitedly, as though trying to shelter her brood; just as quickly I had noticed a chick in the grass, and moving away to a short distance we watched her from behind a bush. In a minute or so she flew over the rhine to the swampy woodside. This rhine, or large ditch, is one of many which intersect our moorlands for drainage purposes; it is about eight feet across from bank to bank, and was fairly well filled with water. With wings drooping and a little extended she moved fussily about, but not so excitedly as she had done when disturbed by us, and then a chick appeared upon her back; the chick had hopped there. Then, with something of a mixture between a hop and a fly, she safely conveyed the chick across to the meadow side which we had just walked up. She returned six more times, and each time conveyed a chick safely over in exactly the same way. To the bird-watcher an obvious query is, How did such young chicks understand from the old bird that they were to jump upon her back? I can understand the latter half of the brood doing exactly as they had seen the others do, but were the first chicks to cross over conscious of what they were about? Did they know what the old female expected them to do? I have noticed with the domestic fowl when brooding that a chick now and then misunderstands the parent's motive, and instead of going under her wing hops upon her back; we can hardly apply this explanation in the case of the young Pheasants, for with them there seemed to be

no misunderstanding; they did just what the old bird wanted them to do, and she was fully conscious that for their very existence, either for food or to escape danger, they were to cross the ditch.—STANLEY LEWIS (Wells, Somerset).

Leach's Petrel in Worcestershire.—On September 19th, 1914, Mr. T. E. Doeg, of Evesham, sent me an example of Leach's Petrel (*Oceanodroma leucorrhœa*), which had been picked up dead in a field near that town the same morning. Mr. H. E. Forrest records one ('British Birds,' vol. viii. p. 198) caught alive near Shrewsbury on the previous day, which subsequently escaped, flying off *down* the river; it might not improbably have reached Evesham by the following day and be identical with the one I have.—THOMAS GROUND (Moseley, Birmingham).

Sense of Direction in Birds.—Dr. Dewar's paper on "The Sense of Direction" brings us "no forader." How does he explain the performance of the young Cuckoo, which, deserted by its parents in England, is yet capable of following the old birds to their winter quarters in Africa? It never made the voyage before, and its parents, which have left the country weeks, sometimes months, previously cannot act as guides. The Polynesian Cuckoo, inhabiting the Kermadec Islands, makes two voyages of nearly one thousand miles each, annually, to New Zealand over the enormous waste of waters in the Pacific, for the purpose of breeding. How do the young find their way back over the ocean? Can Dr. Dewar suggest any solution of this problem?—RICHARD M. BARRINGTON (Fassaroe, Bray).

Curious Nesting-places of the Mistle-Thrush; Distribution of Thrushes in Winter.—Referring to the 'Transactions of the Paisley Naturalists' Society,' a notice of which appears in the 'Zoologist' (ante, p. 79), a curious nesting-site is recorded of the Mistle-Thrush, *viz.* on the tops of tombstones. This reminds me of another curious nesting-place of this species which Mr. Forrest, author of the 'Birds of Shropshire,' along with my son Rosse and others, found in a quarry on the slope of one of the mountains in North Wales. In Airedale this species scarcely ever builds its nest except in trees at altitudes varying from four to twenty feet, but in the neighbouring valley of the Wharfe I have twice found it built in stone walls, and in a district which was within easy distance of much more apparently natural nesting sites. Referring to the distribution of our indigenous Thrushes in the winter season, the Blackbird is by far the most persistent, similar to what obtains in the Paisley district, but the majority of these are male birds. The separation of the sexes,

however, is not so marked as in the case of Chaffinches. The question that naturally occurs to one's mind is, Are the Blackbirds that occur here in winter indigenous or immigrants? In all probability some are immigrants, as may be inferred from the fact that some striking varieties which have come here in autumn have left on the approach of the breeding season. In some winters—as, for instance, in the winter of 1879–80—the Song-Thrush is practically absent from this district.—E. P. BUTTERFIELD (Wilsden).

Starling and Sparrow in Captivity.—Miss Twyman's interesting notes on the Swift, &c., referred to by the Editor (p. 40), remind me of some experience I had with a Starling and a Sparrow kept in captivity. The Starling I obtained from a barrow-man, who was ill-using it, by pulling its long tongue to show its capacity for talking like a Parrot. Having got it home, I put it into a cage, where it soon made itself at home. A few days after, I saw our Cat with a recently caught Sparrow, which I was able to rescue and put into a cage, which I placed within a yard or two of the Starling's. Though not ideal cage-birds, they were model neighbours to each other, and I found them quite interesting. The Starling became very tame and sociable. If it found the cage-door open while I was having a meal, it would get on my shoulder and ask for some of it. The end of my two pets was rather pathetic. One morning I found the Starling dead in its cage, and next morning the Sparrow was dead. I had them a little over a year.—J. ROSE (Binstead, Isle of Wight).

The Meaning of "Katones."—On reading Mr. Aplin's note (*ante*, p. 68) quoting from 'William of Worcester,' it occurred to me that "Katones" might be a corruption of, or have some connection with, the Spanish word "Patines." This word ("Patines") was in use as a name for the Manx Shearwater in Ray's time, two hundred years ago, for he gives it as one of the names of this species in his 'Synopsis Avium,' 1713 (see Pennant, *Brit. Zool.*, 1776, p. 465). The name also appears in the 'Dictionary of the Spanish Academy, Madrid,' 1822, as that of a bird "not uncommon on the northern coasts of Spain, which is black above and white below, with white marks on the wings and which feeds on fish, and flies and runs upon the surface of the water." A Shearwater, or Petrel, of some kind is pretty clearly indicated by this description, although the dictionary goes on to give as a Latin explanation, *Fulica atra*, which is obviously wrong. The sound of the word "Patines" might, I think, be mistaken for "Katones" by this author, who seems to have been

careless in such matters, or not very quick at differentiating sounds ; he seems also to have got his information as to place-names by word of mouth, and would probably get his bird-names by the same means. If dictionaries are to be depended upon, though it must be allowed they are unsatisfactory sources of ornithological information, I should be disposed to think the word "Patin" as meaning Shearwater has now become obsolete, for in the new edition of Velasquez, 1912, it is applied to the Goosander, whereas the Spanish name for Shearwater is given as "Pico-tijera," the English equivalent of which (Scissor-bill) is usually applied to a *Rhynchos*. Mr. Dresser, in his 'Manual of Palæarctic Birds,' states that the Spanish name for the Manx Shearwater is "Animas, diablos," a misprint most likely for "Animas-diablos," which is, however, correctly printed in his 'Eggs of the Birds of Europe.'—THOMAS GROUND (Moseley, Birmingham).

In Rodd's 'Birds of Cornwall,' the editor, Mr. J. E. Harting, quotes the passage cited by Mr. Aplin from the 'Itinerarium Wilhelmi Botoner,' which contains the mysterious reference to "Katones et muscæ, id est mowses," and suggests that "Katones" is a misreading for "Capones," *i. e.* Fowls. In 'The Gannet, a Bird with a History,' the same passage is again quoted (p. 315, *note*) with the suggestion that "Katones" should read "Ratones," *i. e.* Rats. A third rendering was put forward by my father, that the word was meant by Botoner to be "Catones," *i. e.* Cats. Considering the loose way in which Botoner kept his journal, all these explanations are possible, but the last seems to be the best, for if there were Mice on the island, a Cat or two might have been introduced from the mainland to keep them down.—J. H. GURNEY (Keswick Hall, Norwich).

A MISREADING, if any, would have been in the transcription of the MS. of the 'Itinerarium' when it was printed in 1778. It is possible that a mistake was made then. I quoted from Nasmyth's edition, the only one I know. "Katones" and "Kahoues" look something alike, printed, as the Editor suggests. But whether they would look so much alike in a MS. of that date is another matter. The *sound* of the two words is quite different. "Cahow" is, I suppose, a name of Spanish-American or of West Indian origin, and I do not think it is in the least likely to have been in use in Wales in the fifteenth century. Possibly the author bungled the word, as he did when he made "Kermherentes" out of Cormorants, or something like it. But, even so, I cannot think what the name could really be. I might have said that the author mentions "Pophyns" in his account of the Scilly Islands.—O. V. APLIN (Bloxham).

Rose-coloured Starling in Bedfordshire.—An adult male Rose-coloured Starling (*Pastor roseus*) obtained in the above county has recently been examined by me. It was picked up dead in October, 1913, by some children between the villages of Ravensden and Thurliegh. It was eventually taken to a taxidermist in Bedford, by whom it was purchased. The only other county record that I am aware of is a young bird of the year, shot at Barton-in-the-Clay in August, 1855 (see also 'The Naturalist,' vol. 6, p. 20).—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

R E P T I L I A.

Colour Variations in a Chameleon.—A North African Chameleon in my possession a short time ago underwent variation of colour, whether placed against materials or on plants. The colours shown were various shades of brown, black, and cream, and on one occasion pink. The resemblance was more successful in the dull colours than it was in the more brilliant ones. It did not seem that visual realization was necessary, for the changes also took place when the animal appeared to be asleep, or at any rate when his eyes were closed. He would go to sleep one colour and awake a totally different one, without any apparent effect other than in the skin.—(Miss) M. CALLARD (Dulwich).

B A T R A C H I A.

Colour Transitions amongst Batrachia.—In July of 1911 I found three Toads amongst the heather on the top of one of the hills in the Hog's Back. They were a good half-mile from the nearest water, and the heat was such that several heath fires had occurred, yet the creatures managed to survive and appeared in good condition. When captured, their skin was of a distinctly purple hue, blending well with the heather and the dull red of the whortleberry bushes. They were put in a box of dry brown leaves and kept in the dark until the following day, by which time they had assumed a less brilliant grey-brown colour. This colour continued with slight variation of tone during the remaining months I had them in captivity.—(Miss) M. CALLARD (Dulwich).

C R U S T A C E A.

Planes minutus at Padstow.—On January 14th, 1915, at Padstow, Cornwall, a large male specimen of the Sargasso Crab (*Planes Nautilograpus minutus*) was found alive on a baulk of timber

(covered with large barnacles), which was stranded on one of the beaches of the estuary of the River Camel, about a mile and a half from the sea. This Crab was identified at the Marine Biological Association of the United Kingdom at Plymouth, and will be placed in the Association's collection at that place.—A. ST. GEORGE SARGEAUNT (Exbury, Padstow).

OPHIUROIDEA.

Rate of Regeneration in a Brittlestar.—The Common Brittlestar (*Ophiothrix fragilis*) shown in the accompanying illustration was placed in an aquarium at the Horniman Museum on the night of October 19th, 1914. The Brittlestar had broken off the distal ends of each of its five arms shortly after capture on that day, but the animal was healthy, and the lost ends have been in great part re-



generated. At the time of taking the photograph (1.30 p.m. on February 19th, 1915, *i.e.* one hundred and twenty-two clear days after fracture) the regenerated portions were respectively 6, 5, 4, 7, and 6.5 mm. in length. The average length of the regenerated parts of the five arms on February 19th was therefore 5.7 mm. If 5.7 mm. in one hundred and twenty-two days could be assumed to be the average rate of regeneration in the arms of other individuals of *Ophiothrix fragilis*, then we may conclude the average rate in a year to be about 17 mm. There are six other Common Brittlestars in the aquarium, all of which are regenerating lost parts of their arms, but I am not quite sure of the dates on which the arms were broken, and I cannot therefore calculate the rate of regeneration.—H. N. MILLIGAN.

NOTICES OF NEW BOOKS.

The Fauna of British India. Mollusca.—II. (Trochomorphidae—Janellidae). By G. K. GUDE, F.Z.S. London, 1914. Taylor & Francis.

IN the present volume of the Molluscan section of the 'Fauna of British India' the high standard of that unrivalled publication is maintained, both in get-up and matter, while the illustrations are numerous. Although, of course, the book is mainly of interest only to specialist students of Mollusca, and in particular to those concerned with the Land Gastropoda, several facts of general bionomical interest come to light therein.

Notable is the fact that in the genus *Corilla*, of the *Helicidae*, the barrier-armature of the mouth of the shells of the young is invariably different from that of the adult Snails, and especially that in *C. adamsi* such armature is confined to the young, the adult dispensing with this armature altogether.

Such a case is curiously paralleled by that of the Madagascar mammal, the Tenrec (*Centetes ecaudatus*), which is spiny when young, and merely bristly when adult. Another curious parallel between mammals and Snails occurs in the distribution of two Indian forms. Mr. Gude comments on the curious fact that a Snail of the genus *Vallonia* (*V. miserrima*) occurs in the Anamulley Hills in Southern India, though the genus is a typically northern one, and none of the other Indian species occur south of the Punjab. Now, among the Goats, typically northern animals, we find that of the two Indian species of the genus *Hemitragus*, one, the so-called Nilgiri Ibex, is confined to Southern India, far to the south of the haunts of its relative, the Tahr (*H. jemlaicus*), a well-known Himalayan animal. As the specimens of *Vallonia* were collected by Colonel Beddome before any European had visited the locality where he obtained them, the possibility of artificial introduction, so potent a factor in the distribution of land Mollusca, is excluded.

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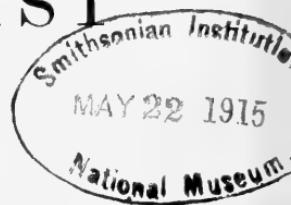
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ORNITHOLOGICAL REPORT FOR NORFOLK (1914).

By J. H. GURNEY.

(Assisted by Members of the Norwich Naturalists' Society.)

In spite of the valuable notes which local naturalists are always good enough to contribute to this annual Report, Norfolk ornithology for the year 1914 is represented by but a meagre budget. The Waxwing invasion soon spent itself; it created some excitement while it lasted, but all about the so-called "harbingers of famine" has been pretty well chronicled. They continued to be fairly numerous during January and February, but none were seen later than April 5th (R. Colman), by which time most of them were probably dead. They were even more abundant in Belgium, but no single flight either there or in England equalled what were seen in Toul, in Eastern France ('Revue Fran. d'Orn.' 1914, p. 315).

The Spring Migration.—I was in the south of France with my son in April watching Bee-eaters and White-winged Terns, and therefore had no opportunity of recording the arrival of spring migrants in Norfolk, yet I could not fail to remark one thing, which has struck me before, *viz.* how very little difference there is in the dates of their arrival on the shores of the Mediterranean, and the shores of the English Channel. The passage through France of such birds as Swallows, Nightingales, Redstarts, Cuckoos, Warblers, Whitethroats, and Flycatchers must be performed in a very few days—that is certain. But although I was absent, the Rev. M. C. Bird, of Brunstead, kept

notes as usual, with which he has been good enough to favour me. These were only normal, but the incoming of migratory Rooks in February and the great flight of Starlings in March were abnormal.

The Breeding Season (Cormorant, Spoonbill, Little Owl).—The principal event which the breeding season was remarkable for was the nesting of a pair of Cormorants on a lake of Lord Hastings', in the north of Norfolk. This event carries us back to the sixteenth century, when William Turner wrote (in 1544) that he had himself seen them nesting "in Northfoleia cum ardeis in excelsis arboribus." When this ceased we cannot say, at any rate we have no record of their breeding in Norfolk since the seventeenth century (Sir Thomas Browne). When my father was a boy, there was a small colony of Cormorants at Fritton Lake in the north of Suffolk, but I do not think he ever visited them, although he alludes to the settlement in the 'Zoologist' for 1846 (p. 1382). His collection still contains a fine specimen in breeding plumage, which I imagine to be the same that he records as shot on this lake on April 4th, 1848 ('Zoologist,' vi. p. 2185). That a few pairs went on breeding, or trying to breed, as late as that is quite probable. Colonel H. M. Leathes implies that such was the case ('Unnatural Natural History Notes,' p. 57); and not many years ago a dead tree was still standing on his side of the lake, which, according to tradition, had been killed by their excrement.

In 1879 Lady Crossley's decoyman was positive that no Cormorants had nested either at Fritton or Herringfleet for many years, or at least in his recollection, but with protection they might probably be induced to return.

In the opinion of the late Professor Newton, the Spoonbill was in former days in the fullest sense of the word a native of England, and there is no reason why it should not become so again. Accordingly, throughout the summer, protection has been afforded to any which had the good sense to avail themselves of a sanctuary on Breydon mud-flats. One longs for the time when a pair or two of these splendid birds may again breed at Reedham, where there is a wood admirably suited to them, in preference to the marshes of Holland. Mr. S. H. Long, who has recently been in that country, kindly obtained from the

Secretary of the Netherlands Protection Society some particulars about the laws enforced there, which are somewhat strict and require to be observed by visitors. It appears that for many years there have only been two, or at the most three, carefully watched Spoonbill settlements in Holland, which at the present time are situated as follows, *viz.* : one on the Naardermeer, near Amsterdam, where there were ninety protected pairs of Spoonbills nesting in 1913, and one at Zwanenwater, near Helder, where about a hundred and fifty pairs were nesting. I learn from Mr. Long that, by applying in the proper quarter, leave can be obtained to visit Zwanenwater, but Naardermeer is barred alike to natives and foreigners. Of the two places, Zwanenwater is slightly the nearest to Norfolk, its position on the map lying a little to the south-east of the latitude of Breydon.

Looking back some two hundred and fifty years, it is with a feeling of curiosity that we remember that in June, 1663, the botanical studies which John Ray was prosecuting with such vigour took him and his pupil Willughby to Holland, where they found Spoonbills breeding near a village called Sevenhuys, situated at four leagues (about thirteen miles) from Leyden, not in marshes but as they did in Norfolk, "in great numbers on the top of high trees" ('Ornithology,' p. 289). This settlement, from which the young Spoonbill described by Willughby was probably taken, has long since become extinct, for even in Pennant's time the wood where Willughby saw them breeding had been cut down ('British Zoology,' ii. p. 634). At the present day this would have been of less consequence, for trees do not seem to be required, piled-up reeds being preferred by European Spoonbills, which, like Herons, vary considerably in their habits. A somewhat fuller account of this visit to Sevenhuys, and of the four species, including the "Lepelaers," as Spoonbills were called in Dutch, found breeding there, is supplied by Ray in his journal of 'Travels through the Low Countries' (second edition, 1738, p. 33), one of the very few references to Natural History to be discovered in that somewhat disappointing volume.

Little Owls which had escaped the enemy were seen at Honingham by Dr. Deacon, near Swaffham by Mr. Buxton, and at Surlingham. This species, which was first introduced into

Norfolk by the late Earl of Kimberley, would undoubtedly breed in the country if it were not so persecuted.

The Rev. E. T. Daubeney finds that this Owl is partial to centipedes, and in the gizzard of one which was unintentionally trapped at Costessey, Mr. B. B. Riviere discovered only Beetles' wing-cases. A motion before the County Council to except this species from the Norfolk schedule of protected birds was not carried, which shows that it is not altogether without friends among our landowners, the majority of whom know that the good it does outbalances the killing of a few Pheasants. Indeed, an excellent plea in its defence may be made out by the admirers of this comical little Owl.

The Autumnal Migration.—It is many years since the East Coast has had an autumn when rarities have been scarcer; in fact, I doubt if there has been one in the forty-eight years during which I have been a contributor to the 'Zoologist.' This may be because some of our observers have gone to the war, but the commoner species have not come over the sea in the same bulk as in some years. On the other hand, on the Kentish coast, where a good observer was placed, migration seems to have run strong (see 'British Birds,' p. 226). As in former years, Mr. F. J. Richards, who watched the Norfolk coast to the west of Cromer, was careful to jot down full memoranda of both the wind and the birds, if there were any.

The wind was registered as north-east on September 5th, and it continued principally in that quarter up to the 10th, during which time, although constantly on the look-out, he did not see a single migratory bird of any rarity on the coast. On September 11th the wind shifted to south-west, and continued in that quarter until the 17th, but Mr. Richards saw absolutely nothing indicative of migration, either in the *Suæda* bushes or on the sandhills. The explanation probably was that the throng of Wheatears, Warblers, and Redstarts, as well as the usual Pied Flycatchers, Bluethroats, Barred Warblers, &c., had come to Norfolk before the 11th, and there being no head wind to delay them, had passed on to the south in the night unseen.

On September 18th Mr. Richards saw one solitary Redstart, the wind then blowing strongly from the north-west. After that day he saw nothing on the sandhills or among the *Suæda* bushes;

but on the 19th and 20th, with a very strong wind from the north, several Ducks were observed to pass. All this agrees with what can be gathered from more inland sources, and especially from the Broads.

Mr. Vincent considers it to have been the worst autumn season for many years for migratory Mallard in the neighbourhood of Hickling, although at one time Pochard showed up strongly, there being something like fifteen hundred on the Broad.

The Winter Migration.—The arrival of the Wood-Pigeons in December was viewed by our agriculturists with mixed feelings, for if this bird were to increase largely it would become a pest. That the Wood-Pigeon, which lays only two eggs, should be such an abundant species is somewhat of a marvel, but there are similar cases which might be cited; *e. g.* the Puffin lays only one egg, yet is so abundant that it is thought to be the dominant bird in Europe.

The absence of the Little Auk during the winters of 1913–14 and 1914–15 was as marked as was its superabundance in the two preceding years (*viz.* winters of 1911–12 and 1912–13). But what made it especially remarkable last winter was that on the Ross-shire coast there were thousands ('Scottish Naturalist,' 1915, p. 69). This erratic little diver comes and goes, but we are beginning to understand pretty well what governs its migrations, which often do not extend so far south as Norfolk.

Absence of Rarities.—The only rarities of this unproductive year worth calling attention to were a Bluethroat in June, a Grey-headed Wagtail in September, and a Little Bustard in October. Again, we had one or two Roseate Terns on the coast, which may possibly have had mates and bred.

A dagger (†) against the name of a species indicates, as before, that the recorder is responsible for its identification. Rainfall for 1914: 27·64 in. (E. Knight). Prevailing direction of the wind: west.

JANUARY.

1st.—Frost and snow; a Waxwing at Northrepps. On the surface of the grass the thermometer fell to 19°.

2nd.—[A Ruddy Shelduck taken at Blakeney, and in the course of the month Mr. Pashley received another† from Stiffkey,

but they may have been "escapes," although the second one was in perfect plumage.]

3rd.—A Black Redstart trapped at Hellesdon, near Norwich, is noteworthy on account of the inland locality.

19th.—Smew at Potter Heigham (E. C. Saunders). Two hundred Teal and two Water-Rails on some ponds near Holt.

31st.—Mistle-Thrushes treading at Brunstead. In a few days the hammering of the Nuthatch will be heard.

FEBRUARY.

1st.—Two Goosanders on Holkham Lake (S. H. Long), and later four came to Gunton Lake, where hungry Gulls watched them diving, hovering overhead in hopes of wresting a fish or two from them (G. Davey).

2nd.—Merlin † at Hellesdon (J. Berners), killed in mistake for a Wood-Pigeon; and another shown me by Dr. Long met its death in the same tragic way. Three Waxwings † at St. Giles's Gates.

6th.—Mr. Arthur Patterson reports the presence of four White-fronted Geese on Breydon Broad, to which Mr. Saunders adds a fifth, an unusually small bird.

7th.—Hawfinch † at Keswick and Gadwall on Rollesby Broad (H. Brownswood).

9th.—Barn-Owl † on a small Scotch fir, where, from appearances, it must have roosted some time.

14th.—Bittern booming (Miss Turner), weather fine and open, oats being sown. The next day there was a Chiffchaff, harbinger of spring, on Breydon "wall" (F. Chasen).

17th.—From now to March 2nd Mr. Chasen observed a marked arriving of Rooks, with Jackdaws and Hooded Crows, at Yarmouth and Caister, many being seen to come off the sea. During all this time the wind, with two exceptions, was west or south-west, so the Rooks must have been flying against it. This immigration of *Corvidæ* in February and March may perhaps be an annual one; at all events it has been noticed at Yarmouth before ('Zoologist,' 1912, p. 419, and 1913, p. 362), as well as at Lowestoft by Sir E. Newton and Dr. Ticehurst ('Norwich Nat. Trans.', ix. pp. 422, 615), and at Aldborough. Here the late Dr. Fenwick Hele looked upon it as being the result of north-westerly winds (see 'Zoologist,' 1870, p. 2140),

as it certainly was in one case at Yarmouth ('Nature in Eastern Norfolk,' p. 148). It certainly is most singular that a westerly movement should be going on in the very month (*i. e.* March) in which thousands of Rooks and Crows are quitting Norfolk for the east, but it must, I think, be due to the wind.

18th.—At East Harling Sessions, Edward P —, a game-keeper, was charged with shooting a Bittern contrary to the Wild Birds Protection Act, and was fined 20s. and costs—a verdict which will no doubt meet with general approval.

26th.—A very mild day; a Thrush sitting on four eggs.† *Japonica* in flower. Bittern booming again (M. C. Bird).

This is the time when Mistletoe Thrushes begin to chase one another; in Norfolk this common bird always goes by the name of a *Fulfer*, literally a *farer* or *traveller* over fields (Anglo-Saxon *Fealo*, see Bosworth's 'Anglo-Saxon Dictionary'); but sometimes a discerning rustic will call it a *Dow Fulfer*, meaning that in its light colour it resembles a Ring-Dove. By right the name belongs to the Fieldfare (*Turdus pilaris*), and is misapplied by our country-folk.

MARCH.

4th.—Several Wigeon on Breydon Broad (G. Jary). The March passage of Wigeon used to be looked forward to by Yarmouth gunners, in the days when they might be shot, with some eagerness. The following memoranda are by the Watcher:—
 March 4th.—Several Wigeon. 7th.—About a hundred. 9th.—Nearly two hundred. 12th.—About two hundred. 16th.—Wigeon all gone. 19th.—Some have come back. 20th.—A few. 22nd.—All gone. 25th.—Wigeon back again. 27th.—Nearly three hundred. 28th.—More have come. April 2nd.—Not quite so many. 4th.—Shrinking every day. 6th.—Wigeon all gone, after which there are no more entries.

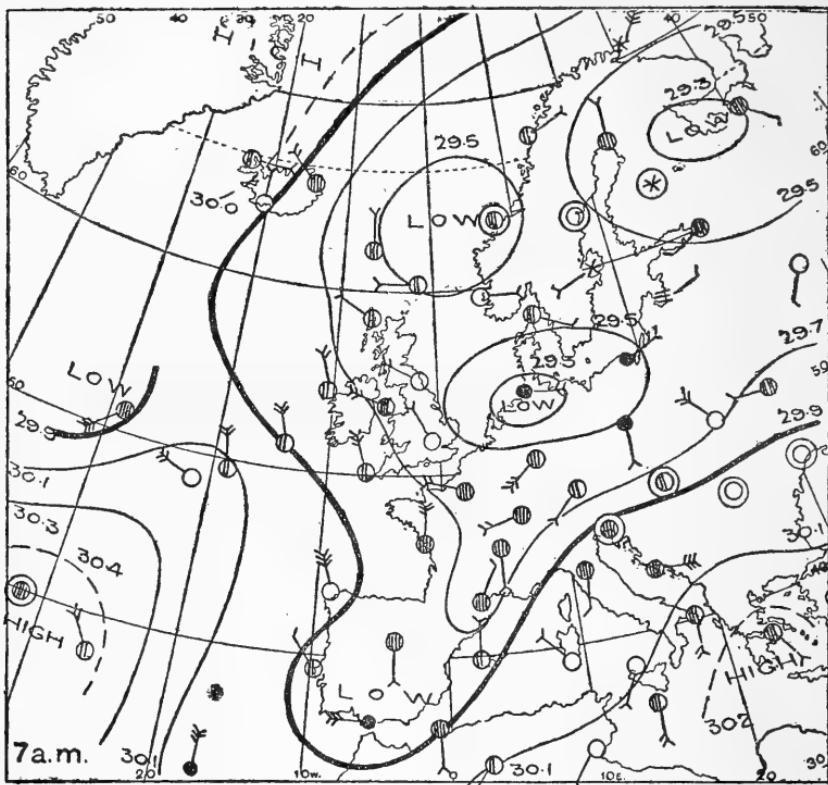
9th.—W.S.W., 2.*—Flocks of Starlings, estimated by Mr. J. Vincent at over five thousand, came in from the sea, and were seen flying west at Horsey.

10th.—W.N.W., 4, at Yarmouth. A sharp fall of temperature in Western Europe, the severity of the drop being plainly shown by the published weather reports from Berlin, Paris, and London. In Norfolk we had showers of sleet, and my men had to stop

* Beaufort Scale.

drilling barley. Mr. F. C. Cook noted a great mustering of Rooks, Jackdaws, and Starlings near Lowestoft (Zool. p. 381); he also remarked that a flock of Starlings was coasting north, and that Rooks were flying at sea.

BAROMETER, WIND AND WEATHER ON MARCH 10TH.



WIND.—Direction is shown by arrows flying with the wind.

WEATHER.—○ Clear sky. ◐ Overcast. ● Rain.

11th.—West, 2, at Yarmouth. *Great Migration of Starlings.*—At Great Yarmouth, which lies some six miles north of Lowestoft, no movement developed until the 11th, when an extraordinary flight of Starlings was seen as early as 6.45 a.m. in the morning. "It extended," writes Mr. William Hardy, of Gorleston, "for perhaps one and a half miles in length, and was of sufficient breadth to cause approximate darkness, very similar to that experienced here on Tuesday afternoon during a snowstorm."

Some allusion has already been made by Mr. Arthur Patterson (Zool. p. 380) to this horde of birds, which, when first seen, were, I believe, less than half a mile from the sea, and travelling in a westerly direction against a gentle wind (registered as W., force 2). On the same day big flocks of Starlings were also seen by Mr. J. Vincent at Horsey, twelve miles north of Gorleston, coming in from the sea, and likewise going west against the wind. This westerly direction is almost as perplexing as their great numbers, for that is a direction hardly to be expected of them in the month of March. My theory would be that this was owing to the wind, for it is to be continually remarked on the rounded coast of Norfolk that birds are very fond of flying against a rather gentle wind, and particularly is this so in the vicinity of the sea, an opposing wind force 2-4 appearing to suit them very well.*

16th.—Rooks and Grey Crows flying south-south-east at Northrepps, in the direction of Breydon, where Mr. A. Patterson has remarked that towards the end of March the latter often collect.

19th.—A Wheatear seen at Yarmouth by Mr. F. Chasen, probably brought from the south by yesterday's gale (S., 6). Another was said to have been seen as early as February 21st (B. Dye). Whether migrants generally were early I did not hear. Snipe were drumming on March 22nd; Pied Wagtails building on the 23rd; two Willow-Warblers at Brunstead on the 27th (M. C. Bird); and a Swallow at Santon Downham on the 29th (W. Clarke); but the Wryneck was not heard until April 3rd.

22nd.—The first birds'-nesting memorandum in my journal (with the exception of a Hedge-Sparrow's nest in an old kettle on the 13th) refers to some very early Moorhens,† which were already quite a week old on March 22nd. At least fifty per cent. of the Moorhens which are hatched probably do not survive a fortnight.

24th.—Weather very fine; Pipistrelle and Brimstone butterfly on the wing. Male Rhea booming loudly in its enclosure. To-day is the anniversary of the terrible gale which blew

* In 'Studies on Bird Migration,' by W. E. Clarke, will be found a valuable chapter on the migrations of the Starling (vol. i., chap. xv.).

down about two million trees in 1895 (see 'Zoologist,' xx. p. 172).

25th.—A Waxwing † near Trowse Church. Marsh-Tits and Long-tailed Tits are now in evidence, apparently hunting for nesting-sites. I have found the nest of the former in a hole in an oak as much as fourteen feet from the ground, but that is unusual; on the other hand, a Rat's hole is sometimes chosen, from which a violent hissing proceeds if the Tit is disturbed when incubating.

APRIL.

7th.—*Spoonbills on Breydon Broad.* Allusion has already been made to the protection which our ill-supported Society* still continues to afford to Spoonbills, a protection of which this year twelve availed themselves. The first one to be viewed on the mud-flats was rather early, appearing on April 7th, but Dr. Long tells me they come to Holland much earlier than this. In all probability its presence was due to a strong west wind (W., force 5) which had been blowing on the previous evening. It was evidently contented with the society of Gulls and their muddy surroundings, and it remained in the creeks, except for short absences when they were covered up and it could not feed, until the 14th. After an interval of six weeks, another turned up on June 2nd (W., 2), and this was joined by three more on the 3rd (N., 2), all in fine plumage, exhibiting white "copped crownes," as Sir Thomas Browne would have said, in allusion to their pendent plumes. They were tame enough to feed within fifty yards of the Watcher's houseboat, and I regretted an engagement prevented my going over to see them. All four took their departure on the 7th (W., 2), but on the 18th (S., 1) three of them came back again. Mr. Patterson, who had an opportunity of watching, thinks they were feeding on Sand Shrimps and Ditch Prawns, which is very probable, as Sheppard and Whitear remark that one killed on Breydon was full of the shells of Shrimps, and another which I had several years ago (October, 1871) had also good-sized Shrimps in its stomach. Mr. Jary does not say how long these three stayed, but on July 4th another was seen, which he considered to be a young one, and if

* Breydon Wild Birds' Protection Society, Hon. Sec., H. P. Frederick, Esq., Great Yarmouth.

so, a bird of the year. On the 31st there were again three (W., 1), which may have been the trio first seen on June 2nd. On August 2nd two Spoonbills were remarked flying out to sea by Mr. F. Chasen, perhaps on their way to Naardermeer, as the following day none were visible on Breydon Broad. However, one came back on the 4th (W., 2), after which the Watcher, who has supplied nearly all the above memoranda, saw no more. Breydon is the only one of the Norfolk Broads which Spoonbills visit, none of the others being tidal, that would afford the food suitable to it. Now and then, however, one is seen on Hickling Broad, probably in search of Sticklebacks (see 'Zoologist,' 1866, p. 348).

11th.—Two Gadwall and twenty Tufted Ducks on Foulmere, and about fifty Tufted Ducks on Langmere, and one Shelduck (W. G. Clarke). These meres lie near Thetford.

21st.—A Woodcock seen on its nest at Hockering by Mr. B. B. Riviere. About this date Mrs. Smith, of Ellingham, assures me she distinctly saw a Snipe pick up one of her brood and fly with it some way, holding it apparently between her legs and her breast (see 'Field,' August 15th). The Snipe made three attempts to pick it up before rising in the air and successfully flying off with it. A similar concern in the case of the Woodcock for the safety of its offspring was reported at Hempstead some years ago. A Woodcock remained at Cranmer until June, but no nest was found (Sir T. D. Pigott).

22nd.—Mr. Riviere reports a Bewick's Swan which had been on Hickling Broad with a slight injury from shot since the 9th. I learn from Mr. Vincent that it took long flights, and did not leave until May 2nd. It was bullied, he says, by a male Mute Swan, which drove it into the reeds and tried to kill it. At no time did it voluntarily associate with the tame Swans which are kept on that water.

MAY.

1st.—Three Cormorants on Wroxham Broad (Springfield), perhaps the same which were on Breydon on April 28th, or these latter may have been the birds which Mr. Cook observed at Lowestoft ('Zoologist,' p. 332), for the Cormorant is not very abundant with us.

11th.—No more nests of the Common Sandpiper have been

found, but a pair, evidently mated and on their way to breed, were picked up dead in a street in Sheringham, having, as was supposed, struck an overhead wire in the night (H. M. Upcher). The male was distinctly spotted on the flanks, which in the female were quite clear.

12th.—Five Knots in red plumage on Breydon muds (B. Dye).

14th.—At the present time there are two Long-tailed Tits' nests † in gorse bushes, both very conspicuous, and that is often the case with nests of this early species, which are built before the leaves have come out. Another nest was in a cherry plum, another in a privet bush, and another was in a wild honeysuckle; on previous occasions nests at Keswick have been built in yews, juniper, whitethorns, thuja, jasmine, and box. Long-tailed Tits are paired by Valentine's Day if the weather is at all favourable, and completed nests* are to be found in March, yet at the same time old birds are still to be seen in flocks.

15th.—An unusual sight was witnessed in the village of Castleacre—a Heron flying along the principal street carrying a large Eel in its beak. The bird was flapping awkwardly within a few feet of the ground, borne down by the struggles of its prey, perhaps impaled upon one of the mandibles, which would quite account for its not getting rid of it. Eventually the bird rose to a greater altitude and made off. (Correspondent of the 'E. D. Press.'.)

18th.—In a "Nature Study" now on exhibition at the Castle Museum, arranged by Mr. F. Leney, the results of planting the contents of a Partridge's crop are shown. Nothing has come up except harmful weeds, including bindweed (*Convolvulus*), *Persicaria*, white goosefoot, and annual *Poa*. The bird was sent up by Mr. Colman, and had been killed near Norwich. A Partridge dissected in Scotland, also in May, by Miss L. Florence, contained

* These marvellous structures attracted the attention of naturalists as long ago as the sixteenth century, the first to describe one having been the illustrious Swiss physician Gesner (1555), who was followed, and at greater length, by Aldrovandus (1599–1603), who had discovered a nest with nine young ones. Salerne, however, perhaps taking his information from Ray, thought they laid twenty eggs. Instances of three or four birds in attendance upon one nest have been recorded ('British Birds,' iv. pp. 79, 209), which would account for such a large number as twenty.

many seeds of the sorrel, sheep's sorrel, and spurrey (*Spergula*). These facts are commended to the attention of farmers.

19th.—The following plants have lately been identified by the School of Agriculture at Cambridge from the crops of Norfolk-killed Pheasants:—*Ranunculus ficaria*, *R. acris*, *Taraxacum officinale*, *Plantago lanceolata*, *Galium aparine*, *Galeopsis*, *Chenopodium album*, *Brachypodium*, *Silene*, and *Polygonum*. That both Partridges and wild Pheasants do more good than harm can hardly be questioned, but when great quantities of tame Pheasants are reared, nature is altered and they become destructive.

23rd.—Montagu's Harrier at Lessingham (Bird).

24th.—Mr. C. B. Ticehurst inspected a nest of the Lesser Spotted Woodpecker at Ellingham. The diameter of the hole,† which was in a nearly dead elm-tree, about seventeen feet from the ground, was 1·3 in. The young flew on June 9th, having been very noisy for some days previously. This Woodpecker appears to be much less common in Norfolk than in some of the Midlands. In East Norfolk it is decidedly rarer than the Greater Spotted Woodpecker, yet in Suffolk the Rev. J. Tuck considers them equally distributed. May I ask if any of your readers have noticed the curious scratches made by Woodpeckers on the trunks of trees, especially the lower portion of oak trees? These indentations are often two or three inches long, and must be caused by the Woodpecker's claws; in most cases they are no doubt attributable to the Green Woodpecker.

27th.—A Guillemot in summer plumage picked up on the beach (B. Dye).

JUNE.

1st.—The colony of Black-headed Gulls on the salt-marshes at Wells has so prospered since their return to "Mow Creek" in 1906 (see 'Norwich Nat. Trans.', viii. p. 494), that there are stated to be this year two hundred nests. On the other hand, the Hoveton Gallery is short of its usual complement, the number breeding there being very small, which the owner attributes not so much to the dry weather as to molestation by Otters, which are accused of killing some of the old Gulls on their nests. At Scoulton their numbers were maintained; this and the Staffordshire settlement visited by Ray in 1662 are the oldest gulleries of which we have any record. My first visit to the

celebrated gullery at Scoulton was with my father as long ago as 1860, and I remember we picked up a dead Gull which had eaten two small birds, apparently a Titlark and a Willow-Warbler. I have never met with an instance of their preying on birds since, but when I had to farm unlet land in the vicinity of Scoulton, the bailiff assured me that, if he was threshing corn, the Gulls would sometimes fly round the stack and catch the Mice as they ran out.

5th.—Sir T. D. Pigott, Mr. H. Upcher, and Mr. Marlborough Pryor found any number of Common Terns' eggs at Blakeney, and a fair lot of Lesser Terns. At Wolferton Mr. Cresswell reports two hundred and eight Common Terns' nests, and one hundred and five Lesser Terns' nests; and at Wells, where they are protected by the Earl of Leicester, I believe they also did well.

6th.—Lord Leicester's watcher at the Wells "Ternery" pointed out a Roseate Tern to Mr. C. Gurney, and later in the month the same or another was identified at Blakeney Point, where there were also some Sandwich Terns (R. Pinchen).

9th.—*The Great Crested Grebe.* Quite a number of Great Crested Grebes on Hoveton Broad, every bend had its tenants and two young ones, for, in spite of laying four or five eggs, the number seldom exceeds two, and if it were not for their mother's backs being a place of safety, the hungry Pike would not allow even that small quantity to escape. Altogether, I think, Mr. Barclay and I must have seen thirty-five, which shows what protection has done for this species, which Richard Lubbock, writing in 1845, thought was in danger of becoming extinct in Norfolk. Mr. Aplin thinks that it is the early or late growth of the rushes (*Scirpus lacustris*) which determines the date of this bird's breeding ('Zoologist,' p. 235). Undoubtedly they like a sufficiency of cover, but I do not remember to have found eggs earlier than May; yet April nests are to be met with. The Grebe does not use all the nests it makes. When a nest is used its interior—at least, on our Broads—is composed of fibrous portions of the "Gladden" (*Scirpus*), which flake off easily, leaving a brown substance like cocoa-nut fibre. Here let me correct a mistake in the Norfolk "Report" for 1906, where, by a slip, the date of some Grebes' eggs on the point of hatching

was entered as April 22nd instead of May 22nd, the latter being quite a normal date.

10th.—*Cormorants nesting in Norfolk.* About this date I received information that a pair of Cormorants—perhaps the same which had been seen on Wroxham Broad—had taken up their quarters on Lord Hastings' lake at Melton, which is nine



CORMORANTS IN NORFOLK, 1914.

miles from the sea. After little more than a week's residence, they were discovered to have taken possession of a deserted Heron's nest situated on a large alder tree on an island in the lake. To this nest,† which was quite forty feet from the ground, they at once began making additions, and by the second week in June it was evident to those on the spot that they had eggs. At the close of the month four young Cormorants were hatched, and, by order of Lord Hastings, strictly protected. A tent was erected near the lake for Miss E. L. Turner, by whom they were several times visited and photographed, and an admirable study of their habits from her pen was afterwards contributed to 'Country Life' (September 19th, 1914) and 'British Birds' (viii.

p. 130). Among other things, Miss Turner observed that these young Cormorants, when little more than a fortnight old, had the same habit as young Gannets of extending and flapping their wings. This is supposed to be done to relax the ligaments and strengthen the pectoral muscles before the final day of departure comes. On August 4th Lord Hastings wrote that the young Cormorants were on the wing, but I was unable to go and see them again. Soon after this some stranger Cormorants from the sea paid them a visit, and on August 20th, to Miss Turner's great surprise, there were no less than ten on the lake. As Miss Turner had to leave, the exact date on which the young took their final departure was not noted, but they all got away safely.

12th.—A Barn-Owl's nest † in a hollow elm at Ellingham contained, in addition to the usual Mice-pellets, the skin of a Mole and a freshly-killed Frog. An instance of their feeding upon Frogs is given in 'British Birds' (vol. v. p. 113), but it must be very uncommon. Neither Altum nor Fernard Lataste include the Frog in their lists. For a Tawny Owl to offer its young a Toad ('Zoologist,' 1913, p. 231) is still more remarkable, for the Toad is a most unpalatable creature. On this occasion, besides the young Barn-Owls, both the old ones were present in the elm-tree, which again is not customary when the young have attained a large size.

13th.—A Bluethroat (the only one this year) was caught alive at Yarmouth yesterday, having entangled itself in a net placed over fruit bushes (B. Dye); this is the first occurrence in June.

14th.—Sixteen Canada Geese in single file flew over Mr. Chasen at Yarmouth, probably the same flock which again passed Yarmouth on the 17th (B. Dye).

17th.—Three Crossbills seen at Northrepps by Mr. Burdett, and in the afternoon another flock of four. On the 19th he again saw four; on the 24th, two; and on the 29th, twelve. A few also turned up in July, but none after the 29th.

JULY.

1st.—This was the hottest day of the year, the thermometer standing at 87°3. Among other events attributable to this state of things was the successful hatching out of eight Rhea's eggs.

But oppressive as it was at Norwich, the temperature must have been very different in Yorkshire, for there was a hailstorm there of such dimensions that the hailstones were compared to large pieces of ice, and several hundred Gulls were killed or maimed ('Field,' July 11th). Norfolk birds were not much affected, except that scores of Herons (old ones and young ones) were endeavouring to find fish on Breydon Salt-water Broad (Jary), which was no doubt owing to the heat having dried up the marsh ditches.

4th.—Mr. Bird reports Sparrows taking oats and some wheat, too, on dry headlands, but partly making up for it by



Plutella maculipennis, C. (natural size).

devouring the larvae of the Diamond-back Moth (*Plutella maculipennis*). This is the month in which they attack our peas and beans, to which may be added barley; even the young are sometimes fed on the soft milky grains. The Framingham Sparrow and Rats'-tail Club, which includes eleven parishes, paid premiums on 6300 Sparrows and 6834 nestlings and eggs, but the efforts of the local clubs do not seem to make much difference. The Raveningham Club paid £17 15s. 7d. on 10,387 Sparrows' heads and eggs.

6th.—Swifts already beginning to migrate.

7th.—*The Depredations of Starlings.* July is the month in which the fruit-eating birds take a heavy toll of our orchards and gardens, to the disgust of the indignant gardener. Those who have standard cherry trees of large size are subject to the daily depredations of Starlings, which laugh at a bell tied up in the tree, and are so bold that they can hardly be kept off by guns or boys. Flocks of them come to the feast, and may be seen audaciously carrying off the full-sized, but hardly yet ripe, whitehearts in their beaks, besides which the ground under the trees is strewn with fruit which these wasteful birds drop when only partly eaten. A paddock near my orchard is full of scattered cherry-stones, all of which is their work; ninety-two dropped stones were counted in the space of fifteen yards, and

practically no cherries, except a few which were not ripe, could be saved for the table, the trees being too large to net. In addition to Starlings, Blackbirds and Jays, the young of which are now as big as their parents, and if possible more greedy, help in the despoiling of the crop, also a few Thrushes; but these latter are not such fruit-eaters as the Blackbirds, and should not be destroyed. Norfolk farmers have long had a grudge against the Starling for grubbing up the autumn-sown wheat, which it begins to do as soon as the blade is two inches high, sometimes for the sake of the germinating grain, sometimes for the wireworm or other grub to be found at its roots; but in either case the young corn shrivels and turns yellow. Their diggings are from three to twelve inches long, or even to twenty-four, and are always where the drills run. Besides these iniquities, Starlings also take a great deal of hard corn which is put down for tame Pheasants, both at the coops and afterwards. At the same time we must not paint the Starling blacker than he really is, for he eats insects, as numerous dissections have proved. The researches of Mr. J. Hammond, Mr. W. E. Collinge, Mr. R. Newstead, Mr. J. E. Kelso, and Miss L. Florence have established beyond question that insects may be considered as the Starling's staple food for more than half the year.*

8th.—A Hooded Crow was seen yesterday near Yarmouth by Mr. Chasen. The breeding of this species in Norfolk, although often suspected, cannot be said to have been proved up to the present.

12th.—Three young Tawny Owls observed by the gardener near an "Owl-tub" at Northrepps, doubtless a family party. I believe there have always been one pair in this wood, except when the vindictiveness of game-preserving, or an accident—such as getting down a chimney—has spoilt it. Wherever they are they soon make their presence known; noticeable also is the constancy with which they cling to a suitable locality. In May Mr. C. B. Ticehurst saw a party of six young Tawny Owls at Ellingham, very unusual if they all belonged to one brood. I have

* In Australia, especially in South Australia and Victoria, where the Starling was introduced, it is now looked upon with great disfavour (see 'Nature Notes,' May, 1905, and 'The Field,' October 1st, 1910), although doubtless it eats insects there also.

never seen a nest with more than four. I omitted to state last year that from a Tawny Owl, shot near Norwich, Mr. Roberts took four large beetles,† identified by Mr. H. Thouless as *Geotrupes spiniger* and *G. stercorarius*.

13th.—During July Mr. T. E. Gunn pointed out a Barn-Owl † heavily spotted on the flanks, belly and lower chest, which had been sent in from North Walsham, remarking that in a long experience he had invariably found that the spotted ones were females. I have heard this before, and am surprised not to see it alluded to in any of our standard works as a sexual distinction.

23rd.—Mr. W. Rowan, who has just returned from a stay at Blakeney Point, writes:—"Hardly a day went by without seeing or hearing some Sandwich Terns, but I could not find a nest. The Common Terns are exceptionally strong this year, and I think seven hundred pairs is a safe estimate, for we measured close on six hundred clutches of eggs, and left many untouched."

AUGUST.

1st.—A young Great Crested Grebe which was accidentally killed in August was dissected by Mr. F. Chasen and found to contain nearly three hundred Grebes' feathers, presumably provided by its parents (at all events in part), as well as several wing-cases of a small Water-Beetle. No satisfactory explanation of these feathers in Grebes has ever been offered, but they must be intended to facilitate digestion and act as a pad against fish-bones, for they can possess no nutriment in themselves. It may be noticed that the feathers drop off a Grebe's body on a very slight touch, so as to be obtainable without the slightest pain when required by the bird.

15th.—Common Sandpiper † at Keswick. Young Flycatchers and flocks of young Starlings about. Young wild Ducks strong on the wing.

17th.—A Spoonbill on Kelling beach (H. Pashley).

20th.—Very early in the morning—about 3 a.m.—eight Green Sandpipers (too many to be one family) were seen by Miss Turner from her observation tent to alight on the edge of the lake at Melton Constable, where they at once began a morning toilet of bathing and preening.

SEPTEMBER.

2nd.—Four Land-Rails were seen by Mr. P. C. Bird to cross the road at Beeston, and on the 18th one † was shot at Keswick, where it is now a rarity. The only other note made in September—usually a prolific month—was the shooting of a Shoveller † on the 23rd at Hempstead, and, later, that an unusual number of that species came to Hoveton.

OCTOBER.

1st.—W., 2. A Little Bustard shot at Barton Bendish (Sir Digby Pigott) is the earliest in point of date yet recorded for Norfolk. Its usual month for visiting us is December.

2nd.—N.W., 2. Thousands of Starlings passing in from the coast at Brunstead (M. C. Bird) may have been a portion of the “incredible numbers” which are said to have flown over Huntingdon at this time (‘Field,’ October 31st); 1914 may almost be called the Starling year for the eastern side of England, and one wonders where they all go to.

3rd.—*A Flight of Gulls.* On October 3rd there was a fresh wind (force 4) from the north-west, in which quarter it had been with some variations for several days. Continuous flocks of Gulls † (principally Herring-Gulls, Great Black-backs, and Lesser Black-backs) were passing Sheringham during the afternoon, all, as usual, going against the wind, and following the line of the coast westwards, and no doubt they were passing Cromer at the same time, where their direction would have been N.N.W. Regularly as October comes in is this phenomenon to be seen on the rounded coast of North Norfolk, and especially at Cromer. Flocks of the species named, with a few Black-headed and Common Gulls (but no Kittiwakes)—averaging fifteen or twenty in a party—slowly wend their way, all in the same direction, hugging the coast and invariably flying more or less against the wind. Sometimes this goes on so long that one wonders where all the Gulls can possibly come from. I imagine they eventually return far out to sea, or at any rate out of sight of land when the opportunity offers of doing so with a wind to their liking. The direction of their flight would then be less often towards Norfolk than towards the shores of Belgium, from whence they could again work their way against the wind to England. How

far this theory fits may be better judged from an article in 'The Ornithologist,' edited by H. K. Swann (vol. i. p. 21).

5th.—Pochard† at Hempstead. Among nine Teal† shot to-day there was a remarkable difference in size.

6th.—N., 4, at 8 a.m.; N.N.E., 3, at 1 p.m. Large flocks of Starlings going north at Beeston Regis (Reynolds).

7th.—N., 1, at Cromer. A great northward coastal migration, Lapwings, Starlings, and Gulls being in great strength, but of this an account has been sent in (T. C. p. 449). Mr. B. B. Riviere is of opinion that the migrants, following the coast-line, turned south at Hunstanton, as observed by him on other occasions (see 'Zoologist,' 1913, p. 177, and 1914, p. 179).

12th.—The remains of a full-grown Water-Rat which a Heron had disgorged lying by one of the ponds. A Heron dissected this month by Mr. Chasen contained the remnants of Mussel-shells, an Eel, a Roach, and two species of Water-Boatmen.*

14th.—Several Gannets going east (R. Pinchin). No wind.

16th.—An immature Gannet found alive on Holme beach (H. le Strange), also a Short-eared Owl, a Rook, a Woodcock, and a Pheasant, or at least their remains on the shore at Caister (F. Chasen), as well as six Razorbills and three Guillemots, which had come in contact with some tarry or oily substance, emanating it is supposed from exploded mines.

21st.—Mr. N. Tracey saw about fifteen Crossbills at Middleton feeding on a larch, the cones of which kept dropping; others were on a spruce fir, sufficiently tame to be photographed.

26th.—A Red-throated Diver,† still retaining its red neck, forwarded from Gorleston by Mr. Patterson. Another† which I found dead on the shore on December 15th also held one or two of the red gular feathers.

27th.—Not a single Common Buzzard or Honey-Buzzard has been announced, but a Rough-legged Buzzard was killed at Somerton (E. C. Saunders); and Mr. Roberts had two more†

* It would appear from dissections that in Scotland Herons eat a good many insects. One shot in Aberdeenshire in June, 1911, contained seventy-one pupæ of Gnats, eleven Caddis-flies, four Water-Beetles, three eggs of a Leech, the hair of a small mammal, one seed of *Potamogeton*, and some grass. Four others also contained similar substances, with the addition of Diptera and Weevils ('Trans. Highl. and Agric. Soc. of Scotland,' 1911-12).

(October 27th and November 7th), both of which had found a dead or wounded Pheasant, on which their last meal had been made. We have had very few Rough-legged Buzzards in Norfolk since October, 1910, and the last visitation was in 1880. When skinning Rough-legged Buzzards, I have observed that the skin of the tarsus will easily peel back to the foot.

NOVEMBER.

3rd.—German fleet bombarded Yarmouth, or rather its roadstead. Several Redpolls on alder trees. Four fresh Sky-Larks under the telegraph-wires (Chasen), and a Nightjar,† probably disabled by the same agency, picked up alive at Northrepps (Barclay).

4th.—Thick fog last night; an adult Gannet dead on the shore (Chasen).

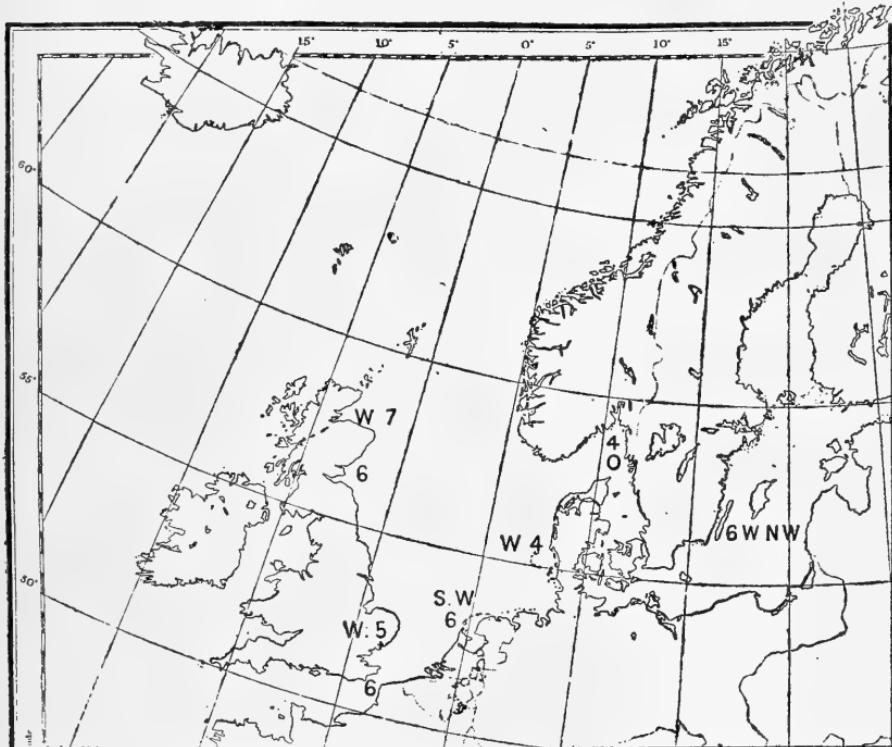
6th.—Short-eared Owl † at Keswick.

14th.—W.N.W., 2, at Yarmouth. About eighty Wild Geese, in two flocks, going N.N.W., noisy and flying low, were seen at Smallburgh by Mr. Bird, species not identified. None were detected on Hickling Broad, but no less than six flocks of Wild Swans—believed from their size by Mr. James Vincent to be Bewick's Swans—comprising ten, four, thirty-two, fifty-two, seven, and twenty-eight individuals, as well as four Whooper Swans (one hundred and thirty-seven birds altogether), were seen by him passing over Hickling Broad. All these Swans, like the Geese, were flying west, that is, going against the wind, which was north-west and moderate. But the day before, when they probably started on their journey, it had been very high, not only in England but on the Continent. At Norwich it was W., force 5; on the 13th at Nairn, in Scotland, W., force 7; at the Helder, on the coast of Holland, S.W., force 6; and in the southern Baltic, W.N.W., force 6 (see map). At Breydon flocks of Wild Swans were also seen coming in from the sea, and then passing west or south-west over the Broad (Jary). At Blakeney I heard from Mr. Pinchin of a flock of about fifty and another of seven, and these also were going west, but further than that the movement was not traced, so it was probably of no very great extent.

15th.—The next day Mr. Vincent saw two more flocks of

Swans, the tail of the squadron, numbering about sixteen and nine respectively, which he believed were also Bewick's Swans, passing over the Broad.

17th.—A Little Auk picked up at Salle; this and one found on the beach at Gorleston on December 12th (Dye) are the only ones reported. The latter date coincides with their appearance in the east of Scotland.



DIRECTION AND FORCE OF THE WIND ON NOVEMBER 13TH.

DECEMBER.

4th.—*Arrival of Wood-Pigeons.* Sir Digby Pigott is informed that at about half-past three this afternoon a gentleman who resides at Weybourne was called out by his servant to look at a little covert behind the house, which is situated only half a mile from the shore. The covert, to quote his expression, was "blue all over with Wood-Pigeons," which must have just rushed in *en masse* from the sea. The wind the previous evening had been high (S.W., 5), and was still blowing pretty hard from that

quarter. The movement, although it does not seem to have been general, was also notified at other places on the coast, *viz.* at Stiffkey, Cley, Northrepps, and Overstrand; at the last-named some Pigeons being seen while they were flying over the sea.*

5th.—*The Food of Rooks and Wood-Pigeons.* My bailiff has again dressed his wheat with "corvusine" (see "Report," 1911), and I hope it has protected it from Wood-Pigeons and Rooks, for wheat at thirty shillings a comb is worth taking care of. Steeping the grain in brine is held of no use, and some farmers still have an objection to "corvusine," which in any case is not often employed for barley or oats. The Rook is in little better favour than the Wood-Pigeon. Mr. B. B. Sapwell, who generally speaks on behalf of the farmers, writes:—"Rooks do much harm to swedes during the winter; they search the rings for any partially exposed roots, and with their powerful beaks peck great holes in them; rain water settles in these holes and rots the roots, and the frost gets hold of these exposed places." It has been truly said that the Rook does an immense amount of harm, but some amount of good, which must not be forgotten. Whatever redeeming qualities there may be in the Rook and the Starling, there are no two opinions as to the destructive character of the Wood-Pigeon. In January the Wood-Pigeon is generally content with acorns, but it is almost the only month in the year in which some crime cannot be laid to its charge. In February they pick out the heads of the red clover, which is coming for hay on the new leys, while in March their presence on the newly sown barley is much too frequent to be acceptable. They are not accused, however, of picking out the grain like Rooks, but are considered to content themselves, as a rule, with what the drill scatters upon the surface. In July they are very fond of oats, besides attacking the young swede crop, which is soon ruined, while in September ripe elderberries are to their taste, and, later, beech-nuts become the favourite food. Of acorns I have often found so many and of such a size as to be

* It may have reached greater proportions in Yorkshire, where I learn from Mr. W. H. St. Quintin, a hundred and thirty-seven were secured by two guns on December 26th. No such bag as that was made in East Norfolk.

astonished that their crops did not burst with them. The rapidity with which they can digest such hard food is equally incredible, and it is a saying that a Wood-Pigeon will eat its own weight in a day! As far as the eastern counties are concerned, any increase in this species is not so much due to the killing down of birds of prey, as to the great amount of land which is planted with green crops, which are greatly to their liking.

19th.—A Stone-Curlew hanging in a Norwich game-shop (Chasen), probably killed at no great distance.

26th.—A Bittern † on Hempstead Mill-pond, where, of course, it was not molested. The miller, who had not heard one before, mistook its booming for a horse in distress. At another place, not many miles away, one was mistaken for a cow! The Bittern's sleepy nature has often been commented upon, and it was not until after a great deal of noise had been made that it rose from among the reeds. Turner calls it "*pigerrima et stolidissima*" (very sluggish and stupid), but it must be remembered that its habits are nocturnal.

VARIETIES.

There are no varieties of plumage of great moment which call for a record. In January, Mr. E. T. Roberts had a pied Lapwing, † and a buff Redwing, similar to one received six weeks before. He also had a white Robin † from Felbrigge in May, and a pale brown Bullfinch † from Witton in December. In February I saw a white Blackbird † in Mr. Riviere's garden in the middle of Norwich, and was informed that it had been there two years. In July I more than once had a glimpse of a white Swallow † at Keswick, which was so conspicuous among its brethren as to be easily picked out at a distance. On August 23rd the same or another was seen at Felmingham (G. Plumbly). A white Snipe † which frequented some meadows at Framingham in October, and which was said to look more conspicuous on the ground than when flying (J. A. Christie), escaped the fowlers until December. Part of its plumage proved to be ash-colour, through which the normal markings could be seen.

Swan × Goose Hybrid.—This singular hybrid, produced by a male Mute Swan and a Domestic Goose, which was described

and figured in the 'Zoologist' for 1911 (p. 174, plate iii.), is still flourishing, but its plumage is getting whiter as it gets older. It has now a companion hybrid,† which was bred on the same pond and from the same father, by Mrs. Reynolds, who is very proud of her unique pair of birds.

MARKED GULLS.

On January 14th a Black-headed Gull ringed in Schleswig-Holstein was recovered at Woodton, and on February 14th another, ringed at Rossitten, on the Baltic, at Breydon ('British Birds,' p. 340). A third, also ringed at Rossitten, was recovered at Stow Bardolph on December 5th (R. S. Smith). From Rossitten to Norfolk is nearly eight hundred miles, but a Gull does not think much of that, I imagine.

NOTES ON THE WAY IN WHICH A STARFISH EATS A PIPE-FISH.

By H. N. MILLIGAN, F.Z.S.

It is well known that the Common Starfish (*Asterias rubens*) will devour almost any animal which it can manage to catch and overcome, but, so far as I know, no precise account has been given of the way in which this animal can make a meal of a large Pipe-fish.

For several months past I have had two medium-sized healthy individuals of this Starfish living in an aquarium. On March 3rd I obtained two specimens of the Deep-nosed Pipe-fish (*Siphonostoma typhle*), which were alive, and two specimens of the \textcircumflex quoreal Pipe-fish (*Nerophis aequoreus*), which were nearly dead, and at 3 p.m. I put all four of the Pipe-fishes into the aquarium which contained the Starfishes. It so happened that one of the Starfishes (which for convenience I will designate as A) was walking towards the spot on which one *Nerophis aequoreus* fell. When it arrived within about an inch and a half of the fish, the asteroid, which had not been fed that day, seemed to become aware of the fish, for it quickened its pace. It placed itself over the Pipe-fish, and at once humped up its disc on its five arms in the manner characteristic of a Starfish which is about to take food.

The way in which the Starfish dealt with such an awkwardly shaped piece of food as a Pipe-fish of about ten inches in length was exceedingly interesting. The asteroid had placed itself over the head of the fish, not, of course, designedly, but because that happened to be the part of the fish which it reached first. The Starfish now supported itself by three arms, *a*, *b*, *c*, on the ground, and one arm, *d*, fastened by its tube-feet to the glass front of the aquarium, in the posture shown in fig. 1, the stiff bent body of the fish resting on the ground at the point *f*. The Starfish laid the arm *e* parallel with the straight part of the

body of the Pipe-fish, the tube-feet encircling and holding the prey. Apparently the asteroid was unable to hold the fish firmly enough in this way, and some ten minutes after taking hold of the fish the asteroid removed the arm *d* from the glass and laid it parallel with the arm *e*, but on the opposite side of the body of the fish, and the tube-feet of the two arms encircled and firmly grasped the fish from both sides, in the way shown in

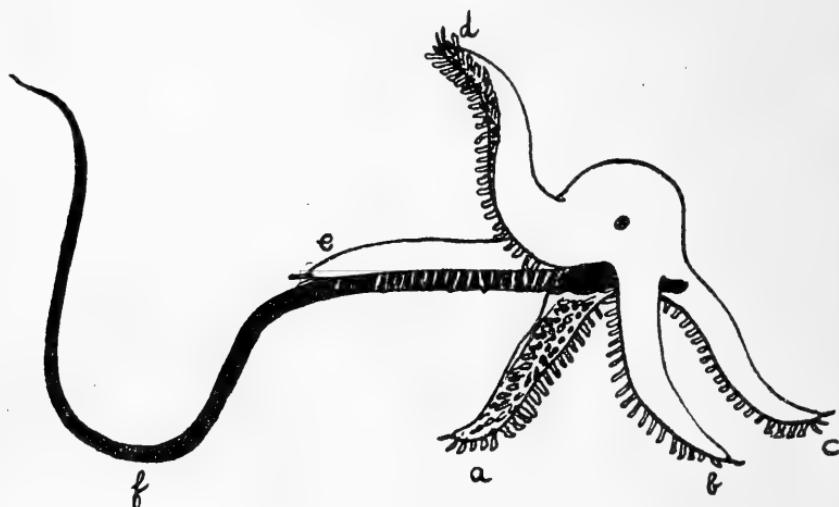


Fig. 1.

fig. 2, some of the tube-feet being attached by their disc-like ends to the body of the fish, while the others were merely laid around it. The Pipe-fish made no attempt to escape; indeed, by this time it appeared to be dead.

On the following morning I found that the Starfish was still sitting over the Pipe-fish. The partially everted stomach of the former could distinctly be seen wrapped round the body of the latter, in the same way that one would tightly wrap a cloth kettle-holder round the handle of a kettle. By this time, however, the asteroid had shifted further towards the tail of the fish, so that the head of the fish now projected far out to the right between arms *b* and *c*. The skin of the hinder part of the head and the eyes, that is the part of the fish which had been within the stomach of the Starfish, had completely disappeared, having apparently been digested.

Some time between 4 p.m. on March 3rd and 10 a.m. on the

4th the other Starfish, which I will call B, had found the second *Nerophis equoreus*, from which it had digested part of the skin and the walls of the abdomen, the contents of the abdomen having disappeared so completely that the vertebral column and the large plates of the sides of the body were, though still in their natural positions, quite clean; in fact, for a distance of an inch and three-quarters the fish had been skeletonized.

At 10 a.m. Starfish B quitted its Pipe-fish, and moved towards the Pipe-fish which was being eaten by Starfish A. Starfish A had been distant only about three inches from B, and it is

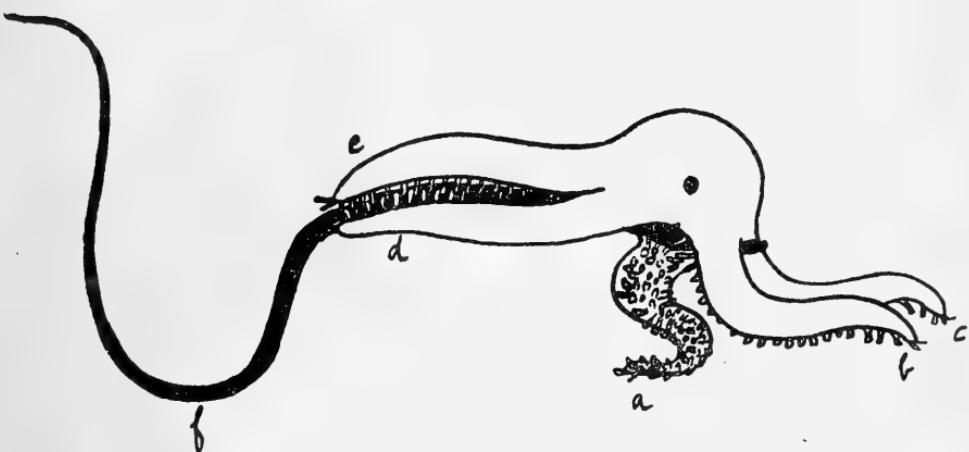


Fig. 2.

possible that the latter moved towards A's prey merely by accident, and not because it had discovered the presence of another Pipe-fish. Nevertheless, when it reached the tail end of A's Pipe-fish it immediately humped up its body in the usual way, and for an hour or so the two Starfishes divided the Pipe-fish between them, Starfish A holding the anterior portion, and B the hinder portion. Starfish B, however, quitted the Pipe-fish without, so far as I could see, having digested any part of it; at all events that part of the fish over which the Starfish had sat had its skin still unbroken. This may have been due to the fact that the hunger of Starfish B had already been almost satisfied, or, as seems more likely, that the constant movements made by Starfish A and communicated to the long body of the Pipe-fish annoyed or frightened away Starfish B.

A little later, though at what time I am not certain, Starfish A also quitted the Pipe-fish, which I removed from the water at about 11 a.m. The eyes had disappeared, together with the contents of the abdomen and the skin of that part of the body of the Pipe-fish which had been within the stomach of the Starfish.

Neither of the two living specimens of *Siphonostoma typhle* has been touched, nor have two of the Pipe-fishes of the species known as *Nerophis ophidion*, which have lived in the aquarium for several weeks, although these fishes lie for the most part quite still at the bottom of the tank, and make little or no endeavour to move away when the Starfishes walk over them. The latter, however, have killed and eaten, within a few months, about half a dozen healthy examples of the Common Brittlestar (*Ophiothrix fragilis*), white fragments of whose skeletons still lie strewn over the sand at the bottom of the aquarium.

NOTES AND QUERIES.

MAMMALIA.

The Distribution of the Polecat (*Mustela putorius*) and Yellow-necked Mouse (*Mus flavicollis*) in Essex.—Up to the first thirty years of the last century, that is, until about 1830, in many parts of Essex, especially those parts bordering on the marshes, the Polecat was fairly frequent—so much so that it was a common occurrence in a day's sport at ferreting Rabbits to see one or two examples bolted by the Ferrets, and there were very few farm labourers who were not familiar with their appearance and power of emitting a most fetid stench, especially when frightened or otherwise interfered with. For many years they have been rare, and it would be difficult now among the younger farm labourers to find one who knows anything of their habits or appearance. They still exist in Essex, although they are very rare, but no doubt Epping Forest will delay their extermination, if not prevent it entirely.

Mus flavicollis.—This, the next species Miss Pitt's enquiries refer to (*ante*, p. 113), is in a different condition, and instead of approaching extermination is more frequent apparently. It is only during the last few years that it has been so generally recognized. It is found in most parts of Essex. If a Long-tailed Field Mouse is caught in a storeroom in a house in this county it is generally of this species. It cannot be said the ordinary *sylvaticus* never enters houses, for it does so at times, but much more rarely than the Yellow-necked variety or species; this being the one usually found in the storeroom in the house, or in the gardener's seed-room.—
HENRY LAVER (Colchester).

Distribution of the Polecat ('Zoologist,' p. 113).—*Bedfordshire*.—The numerous payments for these vermin that are given in the "Churchwardens' Accounts" of so many parishes show that the Polecat was only too common throughout the county up till at least early in the nineteenth century, when the majority of such payments for the destruction of vermin ceased. From such information as I have been able to gather from a past generation of gamekeepers, woodmen, and others, Polecats were still fairly plentiful in the county up to the middle of the past century. From then onwards, probably largely owing to the more extensive preservation of game, their numbers have rapidly decreased, and they became extinct before the close

of that era. The last nine local records that have been recorded were between 1875-1898. Personally I have been able to examine but two of the latter specimens; there is always the doubt of a feral fitchet-coloured Ferret having been mistaken for this animal.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

A V E S.

Occurrences of Aquatic Warblers in the British Isles.—In my paper on "Aquatic Warbler on Migration obtained on Tuskar Rock," published in the March issue of the 'Zoologist' (pp. 81 *et seq.*), I devoted a paragraph to "Previous Occurrences of the Aquatic Warbler in the British Isles," but omitted to mention a subsequent occurrence to that of my Tuskar bird, namely, that of one obtained at Fair Isle on October 23rd, 1914. The omission arose from the fact that when I sent my paper to press I had not received the January number of the 'Scottish Naturalist,' in which Mr. Eagle-Clarke recorded capture of the specimen (p. 5). Two points interested me very much in connection with what Mr. Clarke says about his specimen. One, that "in the dress of rich rufous buff heavily streaked with black on the upper surface, it is a very conspicuous bird." I quite agree. On the other hand, the Sedge-Warbler is not by any means conspicuous, and, as insisted on in my article, these two Warblers are quite distinguishable, *irrespective of the conspicuous medial buff head stripe of the Aquatic Warbler*. The other point of interest is that the Tuskar and Fair Isle birds have been detected in consecutive seasons at areas in the British Isles very remote from one another. This makes us all the more expectant that the distribution both in latitude and longitude of this species may be more extensive than we had thought it might have been. So far my prophecy that we may expect to find the Aquatic Warbler "turning up at light-stations *with increasing frequency*" has been strengthened by this record one year after the occurrence of my Tuskar bird. But we must await further evidence of the increasing frequency of the bird's appearance before we can prove my remarks to be, of a truth, prophetic.—C. J. PATTEN (University, Sheffield).

Birds Travelling North in Autumn.—In the 'Zoologist' for March (*ante*, p. 113) reference is made by my friend Mr. H. B. Booth to the fact that many of our migratory birds, prior to their departure in autumn, are to be found north of their breeding-haunts. I do not think that movement is confined altogether to the larger species, but I am disposed to think it extends to many of our passerine species.

Many of our migratory birds—and even most of what have hitherto been included as residents are, in fact, migratory—rear more than one brood in a season, and it is well known when the young can shift for themselves they are driven away from their homes by their parents before a second brood is reared; and under such circumstances the young may wander to a higher latitude, leading a more or less nomadic life until their food supply is affected by adverse weather conditions; thus there may be some ground for Mr. Booth's suggestion that this habit may account to some extent for the fact that almost every species that is extending its breeding range does so in a northerly direction. There may be instances where a species has extended its breeding range, the facts of which can scarcely be squared by the above theory, as instance the sudden irruption of the Hawfinch into Yorkshire in the seventies. The nesting habits of these were quite different from those which breed in the South of England, and seem to suggest an oversea immigration. It should also be stated that many young birds of the first brood migrate southward soon after they can shift for themselves. I think I have often seen this movement in August when the food supply has been fairly abundant. Verily, there is still in bird migration more than is dreamt of in our philosophy.—E. P. BUTTERFIELD (Wilsden).

Symmetrically-marked Variety of the Redbreast; Individual Attachment in Redbreast.—A day or two ago, crossing a field behind my house, I saw a bird with a red breast with much white in its tail fly into my neighbour's garden and settle in one of his fruit trees, which at first I really thought was a Red-breasted Flycatcher. I ran to fetch my field-glass, but discovered it to be a well-marked variety of the Redbreast. The tail-feathers, at least the outer ones, and the primaries were white; both sides of the bird being very evenly marked, unlike most varieties.

A neighbour called me the other day to look at a Redbreast which has come into her house all winter. She was making bread, and although she went about performing her household duties, it evinced no fear whatever, but hopped about, picking up such food as she kept throwing down from time to time. It resented the attentions of the husband, to the great amusement of the good wife of the house and chagrin of the former, who is a passionate lover of Nature, and would have liked to cultivate a closer acquaintance with the bird.—E. P. BUTTERFIELD (Wilsden).

Fulmar Petrel on Inishtrahull Island, Co. Donegal.—On Tuesday afternoon, September 16th, 1913, a fisherman and native of Inishtrah-

hull Island; Co. Donegal, captured a Fulmar Petrel as it rested on a rocky platform about forty feet above the sea-level. The bird, which was brought to me the same evening, was in no way injured, and was in good condition. On making as exhaustive enquiries as possible, I ascertained that this species had not been known to breed on Inishtrahull, being much better known as *a sea-bird on the wing*, often seen in the vicinity of the island. But being cognisant of the fact that the Fulmar Petrel recently had been found breeding in several localities on the Irish coast, I resolved to make a careful search myself for evidence of its having nested on Inishtrahull Island. To the best of my belief, however, I concluded that it had not heretofore done so. Until a few years ago this Petrel, as far as Ireland is concerned, was regarded as an oceanic bird, which seldom came closer than twenty* miles or so to the Irish coast (Farran). Exceptionally, *i. e.* when storm-driven, it has been picked up on or near the shore. In this way specimens have been, from time to time, obtained, notably by Mr. Warren, on the coast of Co. Mayo. However, on July 10th, 1911, Ussher found it breeding on a cliff on the north coast of Mayo, and was the first ornithologist to publish the fact of the Fulmar breeding in Ireland ('Irish Naturalist,' August, 1911, p. 148). Subsequently he was informed that the bird had bred on the coast of Ulster this year; had appeared the previous year; and had remained during the breeding season. (For details, *vide* Ussher in 'Irish Naturalist,' September, 1911, pp. 149 *et seq.*; also Barrington in *ibid.*, June, 1914, pp. 134, 135.) In May, 1913, the Fulmar was found breeding on the Great Skelligs Rock, Co. Kerry, and the fact was recorded by Mr. Barrington ('British Birds,' July, 1913, p. 56). On July 1st, 1913, Ussher found Fulmars breeding on Tory Island ('Irish Naturalist,' August, 1913, p. 164). The Fulmar is a very abundant bird, and it is well known that it has been extending its range southward on the west side of Europe for many years. There is little doubt that several other localities on the Irish coast, if they are not so already, will be tenanted by this species for nesting purposes.—C. J. PATTEN (University, Sheffield).

Rare Nesting-site for the Goldfinch.—Referring to Mr. Stanley Lewis's remarks on the nesting of the Goldfinch, I may say that in my garden it has nested in the Lombardy poplar, sycamore, Scotch

* On August 10th, 1906, I observed from the deck of a Transatlantic liner Fulmars about seven miles off the coast of Co. Antrim. I have recorded this observation in my 'Aquatic Birds of Great Britain and Ireland' published in 1906, p. 564.

pine, and arbutus. I once saw a Goldfinch's nest in an oak tree, but it was never completed.—ROBERT MORRIS (Uckfield, Sussex).

Parental Instinct in Rooks.—There was in Cambridge in the spring of 1912 an apparently flourishing rookery high up in an avenue of elms. Late one afternoon an unfortunate fledgling fell from the nest and landed with considerable force in the road. He was of a fair size, but his steel-blue skin was covered with feathers only on the wings and head. The loud cries of the young bird quickly brought both parents to the rescue. They walked round for a few minutes as though in consultation, and then each seized the youngster by the wing in their beaks, and attempted to regain the nest. With great difficulty they raised their burden about two feet, when it slipped and fell to the ground. They made a second attempt, which proved equally fruitless, and then finally abandoned the baby. The little creature may have been injured by the fall, for he died three days later, in spite of frequent feeding and the warmth of an incubator. This may have influenced the parents when they left their offspring to its fate.—(Miss) M. CALLARD (Dulwich).

Hen-Harrier in Bedfordshire.—An adult female Hen-Harrier (*Circus cyaneus*) which I examined whilst in the hands of the taxidermist was shot at Crow Hill, Bolnhurst, on December 29th, 1914. The Duchess of Bedford informs me a large Hawk was reported to her Grace, seen some weeks previously at Woburn, which was probably the same bird. This makes the fifth known record for that county in recent years, the majority of which I believe have been adult females. I have no record of any old blue male being obtained. Until the close of the eighteenth century there seems sufficient proof (if one may draw such conclusions from hearsay evidence alone) that the Hen-Harrier nested not uncommonly in at least several parishes of that county.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

Black Redstart in Bedfordshire.—From the continued occurrence of the Black Redstart (*Ruticilla titys*) in Bedfordshire, it is evident that it is a regular though rare winter migrant to that county. Whilst giving a recent observation of this species it may be of interest for comparison to include all the other local records known to the writer. In November, 1860, one was seen by Mr. A. Covington on the old hostelry 'George Inn' in Bedford. About 1865 Mr. T. Cane killed one at Luton and saw another some years afterwards and heard of a third being seen in that locality. December 29th, 1872, a second seen by Mr. A. Covington on St. Paul's Church, Bedford; one, probably the same bird, was killed in Bedford the

following day. March 22nd, 1877, Mr. F. J. Thynne saw an adult male for two consecutive days in Haines Park, and a female or immature male on March 27th, 1880, in the same locality. November 4th, 1890, one killed at Roxton, and another, about 1893, at Great Barford, both of which were perched on the hurdles forming sheep pens. February 17th, 1899, Mr. A. Covington observed a male flitting along a hedge on Clapham Hill. December 28th, 1901, an adult male killed from an apple tree at Kempston. March 3rd, 1902, Mr. A. Covington made his fourth local record, another adult male in Bedford Park, which he watched for some time amongst the trees and bushes there. A female was obtained at Biddenham in November, 1906. Early in November, 1908, one was killed in or near Bedford. Another shot along the highway near the Toll-house at Roxton in November, 1909. In the winter 1911-12 one was obtained near Bedford. The last and seventeenth record was a male seen by Major G. Haines on December 22nd, 1914, at Grounds Farm, Hockliffe, who refers to the weather being dull and frosty at the time. It will be noticed that the majority of records refer to adult males.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

The Meaning of "Katones."—I think "Patines" is quite possibly the explanation of "Katones," although it is not likely to have been in general use in Wales. Ray does not actually give "Patines" as one of the names of the Manx Shearwater in his 'Synopsis Avium.' But in the appendix to that work he describes a bird which he calls "Hirundo marina major. Patines de Oviedo, lib. 14, cap. 1. *The greater Sea-Swallow*," and it is to this that Pennant's reference relates. Ray's description of the bird leaves no doubt that it was a Shearwater, although it may not have been the Manx Shearwater. He speaks of it inhabiting the Atlantic, Madeira, and the Salvages, and approaching the Land's End.—O. V. APLIN (Bloxham).

The Sense of Direction in Birds.—Mr. Barrington's assumption that the young Polynesian Cuckoo, born of parents which have wintered on the Kermadoc Islands, necessarily proceeds in its first autumn to these islands may rightly be questioned (*ante*, p. 115). The Cuckoos bred in New Zealand probably irradiate into Polynesia, where the species has a very wide distribution in winter. The young European Cuckoo has never been shown to be "capable of following the old birds to their winter quarters in Africa," though, it is true, the birds of the year winter in Africa. These young Cuckoos are performing their first outward journey, not a return journey—an important distinction Mr. Barrington has evidently failed to realize.

As it is not possible yet to define the problem of the first outward movements, no solution of the problem can be given, and incidentally no answers to Mr. Barrington's questions, except in so far as the means of keeping a true course is concerned. This faculty, which appears to me to have a similar mechanism in both outward and return movements, I have discussed in my paper published in the February issue of this journal.—J. M. DEWAR (Lauriston Place, Edinburgh).

Coots Infested with Vermin.—In Kent it is a common expression, “As lousy as a Coot!” I recently saw four of these birds shot, and in every case vermin, in appearance like small lice, were found on the dead birds. Can you or your readers inform me whether it is the invariable rule for these birds to be verminous, or was this merely chance? It is well known that any bird under certain conditions will become verminous, but I thought that the expression and my experience might mean that all Coots were so.—HAROLD S. CARLTON (Forest Hill, S.E.).

Willughby's Plate of the Gannet.—The letter from Thomas Pennant to the Rev. Dr. Borlase, communicated by Mr. Aplin (Zool. p. 69), is most interesting, but one is inclined to think Pennant rather severe in his strictures on Willughby's picture of the Gannet, which really is pretty good. Most likely it was drawn from the example which Willughby records to have been picked up alive at Coleshill, in Warwickshire, and which very possibly was kept for a time, for the shortness of the abraded tail is indicative of a bird in confinement. Pennant's own illustration, as Mr. Aplin justly remarks, is also good, which might be expected seeing that it is the work of the clever draughtsman George Edwards. Edwards perhaps, for some reason, was not allowed to reproduce it in his quarto ‘Gleanings of Natural History’ (1743–64), as the Gannet finds no place there. The plate in ‘The British Zoology,’ which represents a Gannet in the act of plunging, was afterwards copied by Bonnaterre in the ‘Tableau Encyclopédique Meth.’ (1790). If intended for an adult bird, it is rather too dark, and the claws, on one of which in each foot the serrations are shown, are too long.—J. H. GURNEY (Keswick Hall, Norwich).

PISCES.

Comber Wrass at Great Yarmouth.—On April 1st a shrimper brought me two small fishes that had been captured in his net the day previously, off the town. He remarked that he had caught two exactly like them last year, “but had lost them somehow,” so he

had made sure I should have the satisfaction of examining these. One of the fish was of a vivid mahogany hue approaching to rose red, and of a colour and shape well depicted in a figure given by Couch ('British Fishes,' vol. iii. plate cxxvi.) and described by him as the Comber Wrass, but with no specific cognomen: Day ('British Fishes,' vol. i. p. 253, plate lxxi.), however, refers to it as *Labrus maculatus* (variety *donovani*).

It is my experience, and the fact is pretty generally recognized, that the *Labridæ* are adorned with gorgeous tints, that intensify under sexual influences, particularly in May, and that the species are also subject to great individual variations in coloration, age and sex also differentiating; their brilliancy quickly declining, and hues actually altering after death. Under these circumstances, and a certain tendency to variation in figuration, the confusion that has existed among naturalists as to a certainty of identification may be excusable, but, nevertheless, leaves much to be regretted as well as desired; indeed, in most of their descriptions given of the *Labridæ* a very considerable space is devoted to argument and disputation as to the determination of species. Personally, I am inclined to give *L. donovani* (Cuv.) or *L. comber* (Ray) a definite place as a satisfactory species.

Mr. R. Q. Couch, son of the author of 'British Fishes,' describes this fish as "the most elegantly shaped of all the Wrasses inhabiting our seas. It is the most slender and most graceful. The head is smaller, the lips thinner, and the jaws more prolonged and pointed than any of the others. I have seen only a single specimen, caught off St. Michael's Mount, but I am informed by the fishermen that several are caught every summer" ('Zoologist'). These remarks well apply to my two examples.

Pennant refers to a Comber "received from Cornwall," and professes to give an illustration of it, which has evidently been copied by the engraver—although the position is reversed—in Yarrell's 'Fishes,' although what he (Yarrell) terms the Trimaculated Wrass (plate xlvi. fig. 120, vol. 3, edition 1776) is drawn to the exact proportions of the fishes before me. My two examples measure respectively $2\frac{3}{4}$ in. and $2\frac{1}{2}$ in., and are immature: the larger was dullish brown, but after a short immersion in formalin became dull red; the other, a red specimen, coming out in the solution vividly red. When fresh the eyes were large and bright red; the body compressed but moderately deep, not so much so as in the Ballan Wrass (a species remarkably well portrayed by Couch). On the cheeks were three bean-shaped white spots, placed in such a position

as to suggest a broad arrow; spots of ivory-white were set in a ground-work of red under the lower jaw. There were no regular lines of white down the sides (as given by Couch), but white dots were sprinkled rather irregularly below the lateral line, mostly towards the tail. The tail showed three white spots at the base, with several more spots, making almost a white band across the centre of it, the fin-rays dividing them. Four bands of white, alternating with red ones, conspicuously marked the dorsal fin, and a horizontal white line divided the broader posterior portion of it. The duller fish also showed white bars on the dorsal fin. Several spots of dark brown were fairly regularly arranged at the base of the dorsal fin rays.

At the moment of writing, the formalin (mixed rather strong, in my hurry to catch a train) seems to be playing tricks with the colours, which are fading on the gill covers. These examples are less unwieldy and more symmetrical than the more Tench-like Ballan Wrass, a fair-sized specimen of which I examined on April 3rd, that had been taken off Cromer. If my fishes represent a true species, they form an interesting addition to my list of East Coast *Labrus*, *viz.* Ballan Wrass, Cuckoo Wrass, Jago's Goldsinny, and now the Comber Wrass.—A. H. PATTERSON (Great Yarmouth).

GASTROPODA.

Appetite of Slugs for Green Material.—Four large black Horse Slugs (*Arion ater*) lived in a fish-globe tied down with a piece of white canvas. They fed upon green leaves of various kinds, and spent their time at the bottom of the globe. In the summer a piece of green muslin was substituted for the canvas. The animals left their food and began to feed on the covering, of which little remained a short time later. They escaped and wandered to the ceiling, where they remained for several days before meeting on a green portière, on which they began to feed. These four always seemed willing to consume green materials, as though the colour were sufficient to guarantee the substance being edible.—(Miss) M. CALLARD (Dulwich).

INSECTA.

A London Bee-hive.—We have kept Bees at No. 22, St. George's Road, Regent's Park, for eight years on a leaden roof, in a frame bee-hive. No swarming has occurred as far as is known, but the honey output has been good, from 15 to 27 lb. a year. The quality has also been good, the sections weighing 1 lb. and over, and fetching normal prices. The Bees originally came from Hampshire.—(Mrs.) J. K. SPIERS.

NOTICES OF NEW BOOKS.

British Birds. Written and Illustrated by A. THORBURN, F.Z.S. In four volumes. London : Longmans, Green & Co. 1915. £6 6s. net ; large paper edition, £12 12s. net.

MR. THORBURN's beautiful illustrations of birds have long been familiar, and it is a pleasure to find him writing as well as illustrating a book on the perennially-interesting subject of our native species. We have no hesitation in saying that the work is easily the best on the subject that has ever been produced with coloured illustrations and of a popular style. In the first volume, now before us, almost all the *Passeres* are dealt with, all, in fact, except the Larks and some of the Crows. Several species are illustrated on one page, the background being wisely subordinated to the figures, which are independent and not grouped in one picture. The colouring is of course excellent, and generally has full justice done it by the reproduction, and the illustrations are all to scale. The attitudes are generally, though in one or two cases not quite, happy ; for instance, the Golden Oriole certainly is not ordinarily seen in the somewhat Blackbird-like pose here given it ; in actions, as in habits, it is more like a Warbler than a Thrush, in spite of its size. We think, also, that the beginner, to whom this book will especially appeal, would have found it more helpful if the name of each bird had been placed immediately under the figure, instead of in a line with it at the bottom ; while it would have been better to use the words "male and female," or even the initials m. and f., rather than the unfamiliar scientific signs (♂ ♀). The letterpress is avowedly subordinate to the plates, but is generally adequate for a book of this character, and Mr. Thorburn has some original observations, such as that upon Nightingales singing on a cold night in a temperature of thirty-eight degrees.

In the preface, with an honesty which is unfortunately not so universal among authors as it might be, he has fully acknowledged his indebtedness to the writers of other works on the subject, and indicated the sources whence those who have acquired an acquaintance with our birds from this most meritorious work of his can proceed to amplify their knowledge of the subject and become full-blown British ornithologists.

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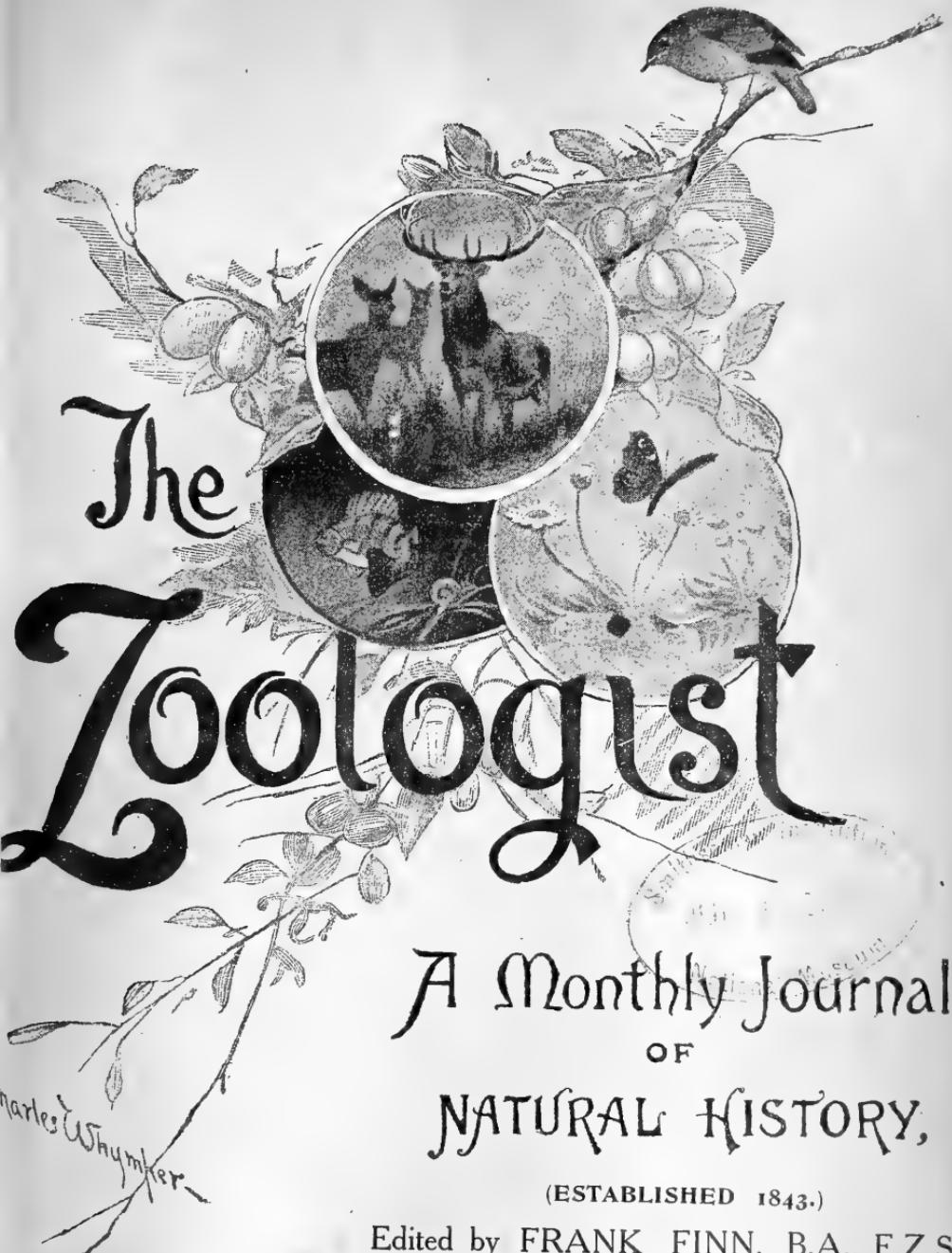
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THE ZOOLOGIST

No. 887.—May 15th, 1915.

NOTES ON THE FAUNA OF THE COUNTRY OF THE CHESS AND GADE.

By T. E. LONES, M.A., LL.D., B.Sc.

(Continued from vol. xviii., p. 461.)

SEVERAL species of bdelloid Rotifers from the country of the Chess and Gade have already been dealt with, and a few others will now be described. The identification of species of bdelloid is more difficult, as a general rule, than that of other species of Rotifers. Further, among the bdelloid Rotifers, I have found most difficulty with species of the genus *Callidina*, but I have examined many specimens sufficiently to satisfy me that they belonged to Gosse's *C. bidens*, and also many specimens which could apparently be none other than Gosse's *C. bihamata*. Another bdelloid Rotifer which will be described is *Adineta vaga*, Davis.

39. *Callidina bidens*, Gosse.—All the specimens so far examined were from moss, and the best and most numerous were obtained on November 3rd, 1912, from moss growing in the lane leading from Abbot's Langley to Upper Highway, and from a much more luxuriant growth of moss near the western end of the lane from Dudswell to Champneys on September 30th, 1913. During the examination of these Rotifers, their movements were so rapid that they seemed to glide over the surface of the glass. Occasionally they drew in their long oral ends, expanded their wheels, and swam through the water, and their wheels were kept expanded when the Rotifers anchored themselves to the slide. Their bodies were somewhat slender and spindle-shaped, and,

except for the brown contents of the stomach, were nearly colourless. No eye-spots were seen, and, it may be stated, importance is attached to this negative character in defining the genus *Callidina*, although it is an admittedly unsatisfactory one. The foot was comparatively short, and the spurs were small, curved, and pointed.

40. *Callidina bihamata*, Gosse.—This Rotifer was found in large numbers in moss from Hyde Lane, near Leverstock Green, on December 19th, 1912, and in the luxuriant growth of moss, previously referred to, near the western end of the lane from Dudswell to Champneys, on September 30th, 1913. In the specimens examined, the trunk was longitudinally ribbed, somewhat swollen, and quite distinct from the head and foot. A very conspicuous feature was the presence at the oral end of two crossed hooks on a short frontal column, and another feature was the dorsal antenna situated at a comparatively great distance from the oral extremity of the Rotifer. No eye-spots were seen. One of the specimens was measured, and found to be about $\frac{1}{80}$ -inch long. The movements of these Rotifers were rapid, the bdelloid progression being effected with great smartness, and the Rotifers usually extending themselves to their full length; this bdelloid movement often passed into a rapid gliding one.

41. *Adineta vaga*, Davis.—In a luxuriant growth of moss, on the Bucks side of Shire Lane, between Cholesbury and Hastoe, several specimens of this remarkable Rotifer were obtained on October 16th, 1913. They were about $\frac{1}{40}$ -inch long. The foot was abruptly separated from the trunk. Two very divergent hooks projected from the oral extremity, and no eye-spot was seen. The head was flattened and its ventral surface was furred; by means of this furred surface the Rotifers moved along the slide. Some of the specimens were seen to anchor and then extend themselves to their full length over the surface of the slide, then rapidly draw back, and then repeat these movements in a different direction, the foot being kept anchored at the same spot on the slide. After repeating these movements until most of the area around the point of anchorage had been covered, the Rotifers moved to fresh positions, where they anchored again and repeated the movements just described.

These peculiar movements, when once seen, can be easily recognized again; and, as far as I know, are characteristic of Rotifers of the genus *Adineta*.

42. *Polyarthra platyptera*, Ehren.—It has already been stated that a distinguishing feature of the rotiferan fauna of Chipperfield Common Pool is its unusually large number of so-called "Skipping Rotifers." At any season of the year, specimens of these can be obtained there. The commonest is *Triarthra longiseta*; a second less common species is *Pedetes saltator*; a third species, *Polyarthra platyptera*, occurs in the pool, but seems to be much rarer, for only one unmistakable specimen of this species has so far been obtained, and that specimen was dead. The oral end of the Rotifer was truncated, and the posterior end was rounded. The width of the body was rather more than half its length. There were two clusters of broad, serrated spines, one cluster springing from the right and the other from the left side of the oral end of the body. Only eight spines were counted, and as this species has twelve spines altogether, the other four had evidently been broken off or decayed. The longest spines were half as long again as the body of the Rotifer, and the innermost pair were symmetrically placed, one on each side, and met at their extremities so as to form with the front part of the Rotifer a triangular figure. This single specimen of the species was obtained on April 13th, 1914, together with a few specimens of *Anuræa brevispina*, the rotiferan fauna of the pool on that date being very poor.

43. *Notommata lacinulata*, Ehren.—This very small Rotifer has been found in small numbers in many localities of the country of the Chess and Gade. The form of the Rotifer is shown in Fig. 19, drawn from a specimen obtained from Parsonage Farm Pool, Abbot's Langley, on April 11th, 1914. This specimen was measured and found to be about $\frac{1}{200}$ -inch long. The greater part of the body was occupied by the stomach, which was filled with a large quantity of food material of a brown colour. This Rotifer often anchored itself to the slide with its

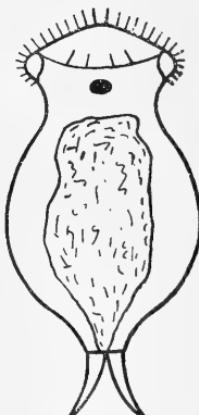


Fig. 19.

toes wide apart, and remained thus anchored for several minutes at a time; in fact, when it was desired to set it free from the slide, it was usually necessary to give it a gentle push with a dissecting needle. There was no vegetable matter on the slide among which the Rotifer could burrow, and, after a few short rapid movements, it usually anchored itself again. Considering the small size of this Rotifer, the water currents set up by it towards its mastax were very powerful.

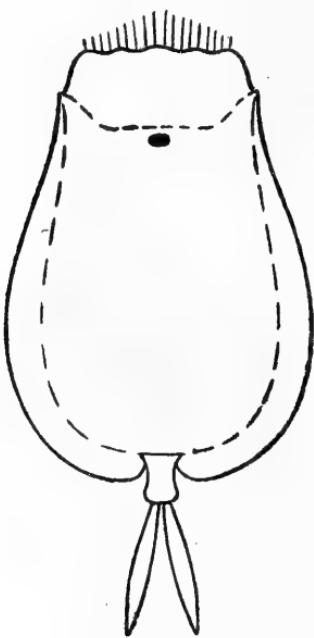


Fig. 20.

44. *Euchlanis dilatata*, Ehren.—This beautiful Rotifer has been found in King's Langley Lodge Pool and in some of the temporarily disused watercress beds near Cassiobury Park, Watford. The largest number was obtained on April 13th, 1914, from the aforesaid pool. They were very active, alternately swimming about and burrowing amongst the small amount of vegetable matter on the slide. Sometimes they anchored themselves by their feet and turned upwards so as to show their bodies in end view; the appearance thus presented was approximately a segment of a circle with recessed edges. In dorsal view, Fig. 20, the lorica was of oval form, passing into a truncated

oral part; the peripheral parts of the lorica were very clear and transparent. A cervical, bright red eye-spot was very conspicuous. The dorsal gap of the oral part of the lorica was but imperfectly seen, the Rotifer's head never being sufficiently retracted to expose it. The rounded notch of the dorsal plate was visible, and from it projected a rather short, jointed foot carrying two blade-like toes. No setæ were detected on the foot. The length of the Rotifer was about $\frac{1}{70}$ -inch.

The forty-four species so far described in these notes represent much of what I have done on the Rotifera of the country of the Chess and Gade. With the exception of a few of them, e. g. *Œcistes stygus* and *Brachionus quadratus*, they are Rotifers which any collector may find with the exercise of a little patience, and are fairly representative of the rotiferan fauna of the district. There are other species already found, notably *Philodina roseola*, *Cyclopus porcellus*, and *Anuræa curvicornis*, on which my rough notes are not sufficiently full. I hoped to be able to continue collecting specimens of these and other species, but since August last my opportunities of collecting have been very few.

A great deal depends on chance when collecting forms of life of any kind, and, in this connection, one of the most interesting phenomena in the distribution of Rotifers is the sudden appearance of numerous specimens where for some time before only a few specimens of a species have been obtained. Several instances of this kind have been given in the preceding notes, e. g. the enormous numbers of *Brachionus rubens* in a pool near Potten End, and of *Brachionus pala* at Coxond, and the large numbers of *Pterodina patina* in Langleybury Pool, of *Anuræa brevispina* in Hastoe Pool, and of *Eretmia cubeutes* and *Noteus quadricornis* in Parsonage Farm Pool, Abbot's Langley. Another instance, relating not to the Rotifera but to the Protozoa, is sufficiently interesting to deserve mention. On many occasions I had obtained a few specimens of *Bursaria truncatella*, Ehren., from the pool at Chipperfield Common. On December 30th, 1912, however, a calm, fairly fine day, with the temperature of the air 46° F., and that of the water of the pool 44.5° F., I obtained hundreds of the above-mentioned Protozoa in every water sample taken. Nothing like this was seen by me before

the date mentioned, nor has it been seen since, either in the pool at Chipperfield Common or in any other pool.

The study of the periodical changes in the relative numbers of forms of life which, like *Synchæta pectinata*, may always be found in one and the same pool, and the study of the appearances and disappearances of forms of life which, like *Noteus quadricornis*, seem to appear only at certain seasons, offer an interesting field of inquiry for naturalists who are able to devote sufficient time to them. Even small pools, like those of Chipperfield Common, Parsonage Farm, Langleybury, and Cholesbury Common, present, as my rough notes amply show, great and varied changes of their inhabitants, both in species and numbers of specimens.

The remarks just made relate to the changes in the fauna of one and the same pool. There is another field of inquiry which seems to be at least as interesting. This relates to the remarkable differences between the faunas of pools in the same comparatively small area. These differences are most strikingly shown when the rotiferan fauna of a pool like that of Chipperfield Common is compared with that of Langleybury Pool, or with that of the Berkhamsted Castle Moats. In these cases, however, the conditions of life are quite different, there being but small quantities of aquatic plants in Chipperfield Common Pool, while Langleybury Pool and the Berkhamsted Castle Moats are normally very weedy; there are also other important differences. It is easy to understand why, in these cases, the rotiferan faunas should be different in a marked degree. What are certainly more perplexing, and perhaps more interesting, are the questions which arise when a comparison is made between the rotiferan faunas of pools in which the conditions of life seem to be more comparable. Take e.g. Langleybury and Parsonage Farm Pools, and the moats of Berkhamsted Castle. All these are shallow, their waters are usually quite clear, their beds are covered by comparatively thick deposits of fine mud, and they contain large quantities of aquatic plants; further, all three are old, and, as far as I know, have not been disturbed for years. A comparison of their rotiferan faunas, based on the preceding notes, shows that several species, viz. *Metopidia solidus*, *Pterodina patina*, and *Salpina mucronata*, are found in all three. These species are

usually found in clear water containing plenty of duckweed, and this plant is very plentiful in both the pools mentioned, and there is a large quantity in the moats. This explains, in no small degree, the aforesaid agreement between the rotiferan faunas.

It is by no means easy, however, to explain the differences in the rotiferan faunas, which differences can be seen best from the following table :—

Species.	Langleybury Pool.	Parsonage Farm Pool.	Berkhamsted Castle Moats.
<i>Colurus caudatus</i>			×
<i>Diglena biraphis</i>	×	×	
<i>Diplax trigona</i>	×		
<i>Eretmia cubeutes</i>		×	
<i>Floscularia campanulata</i>			×
<i>F. coronetta</i>			×
<i>Metopidia acuminata</i>	×		
<i>M. lepadella</i>			×
<i>M. oxysternum</i>			×
<i>Noteus quadricornis</i>		×	
<i>Notommata lacinulata</i>		×	
<i>Oecistes stygis</i>		×	
<i>Philodina citrina</i>	×		
<i>Pterodina valvata</i>	×		
<i>Rattulus ratus</i>			×
<i>Rotifer macrurus</i>	×		
<i>Stephanops lamellaris</i>			×

Further collections might very well show that some of the above species are common to two or all of the above-mentioned waters. The table, however, represents the results obtained from a large number of water samples collected at all seasons of the year and during a period of nearly three years. It may be, therefore, that the differences between the rotiferan faunas of the pools of Langleybury and Parsonage Farm and the Castle Moats are quite as great as the preceding table indicates.

There are several differences between the pools mentioned and the moats. In the first place, they are at different elevations, Parsonage Farm Pool being about 200 ft. higher than Langleybury Pool and 100 ft. higher than the moats. Again,

they differ very much in the degree to which they are exposed to sun and wind. To what extent these differences influence the rotiferan faunas it is very difficult to say, but there are other differences which undoubtedly influence the faunas to a great extent. So far I have not made a detailed examination of these differences. It may be stated, however, that the flora of the moats is much more varied than the floras of the pools, and, while the waters of Langleybury Pool and the moats are modified by the products of decomposition of vast numbers of leaves fallen from trees and shrubs of various kinds which border them, the water of Parsonage Farm Pool contains small quantities of sodium chloride and other salts derived from surface drainage.

When such differences have been examined in detail, a consideration of them in relation to the differences in the rotiferan faunas will probably suggest a maze of perplexing questions, but if attempts to solve these lead to no definite results, there will remain a number of statements of fact which might be of interest to other observers. For the present, however, further consideration of the rotiferan fauna of the country of the Chess and Gade will be deferred, and the next series of notes will deal with the Entomostacea.

A DIARY OF ORNITHOLOGICAL OBSERVATION MADE
IN ICELAND DURING JUNE AND JULY, 1912.

BY EDMUND SELOUS.

(Continued from p. 66.)

June 24th.—A minute or two before 6.30 a.m. the female bird is on the nest. I do not know how long before that. Just afterwards I hear the cry of the male, and at 6.30, when I get to the entrance of the tent, again, the nest (except for the chicks) is empty. Before 6.35 the bird returns and makes a little rejoicing flight about the home-rock, ere alighting on the ledge. She appears then to be carrying nothing, but the instant she alights I see that she holds a mass of flesh in her left claw. She then feeds the chicks, and, at 6.40, broods them. Before doing so, however, and whilst not yet in her accustomed position, with reference to the chicks, upon the nest, she goes through those peculiar movements which I have so often before observed her to make, hunching up her back, bending down the head and tail, and making some sharp and, as it were, spasmodic motions with the latter, that is to say with all that part of the body to which the word tail might be applied, not the rectrices only. These movements, therefore, can stand in no special relation either to the eggs or young, but have to be explained independently of either. The fragmentary nature of what the bird this time brought back to the nest was clearly apparent. It looked as though she had clawed out the whole of the contents of the visceral cavity, and gripped them together in a bunch. The long intestinal canal was the most apparent portion. It hung down in several places—I suppose in loops, but I could see one free end. I have before, during the feeding of the chicks, noticed its whiteness, but did not so much remark it this time. Were the young always fed in this way it would account for there being no remains of such repasts in the nest, for in another

long and careful examination, yesterday, I could detect none, either there or on the ledge. I have, however, plainly seen the viscera being picked out of its containing framework, as also what must, I think, have been a whole dead bird. Yet I have never seen the bird take anything away with her from the nest nor are the excreta ejected from it in defæcation.

7.40.—Bird flies to opposite side of gorge, and preens herself on a small rock or stone, but in less than a minute flies back and continues to do so on the nest. At a minute or two past 8 she goes off, again, and flies down the slope above the opposite side of the ravine. In her descent she skims gradually nearer the ground, and, over the brow of one of its sinuosities, makes a dip at something which might be a brown stone and then flies on. The glasses discover the brown object to be the male Merlin. To assure myself of this, I have to lose sight of the female, but she shortly flies up from another point on the slope, and passes me, not appearing to carry anything. As soon as she perches, however, on the brow of the gorge, facing her nest, I see something considerable in one of her claws, and with this, the next moment, she flies to the nest. As before, it appears to be a ball or bundle of the viscera, and again she holds it in the left claw. The feeding takes six minutes, and, at the end of it, she broods the chicks. She certainly seems now really to cover them, spreading out her pectoral feathers widely around them, and drooping her wings. When flying, this last time, she, as before, bent up her shanks so that what she carried was not distinctly discernible amidst the feathers into which it was pressed. At 9.12 she goes off again and flies to a point on the downward slope of the mountain—the usual direction in which she goes. I there get the glasses on her, and when she flies up again, which is almost immediately, follow her with them right on to the male Merlin, at another point lower down, for she comes into sharp contact with him, causing him to make a little pitch forward, and, grabbing eagerly at something, flies on a little further with it, and then again goes down. It is all so quick that it is difficult to take in every detail, but the grab must have been at something, over and, probably, on which the male stood. He must have been surprised, for a moment, as she came up from behind, but no doubt instantly understood and

surrendered it. I could not pick the female up, again, with the glasses after she had alighted, but she soon flew up and was back at the nest at 9.14, with another lump of entrails, with which she fed the chicks.

At about 10.5 a.m. the female goes off the nest and flies to a promontory of the ravine side opposite her home-rock, and there preens herself very thoroughly for some minutes. She then flies further down the slope of the mountain, and such a speck is she, amidst the waste of moss and vast *débris* of lava fragments, that I cannot find her with the glasses, and, something having intervened, I only see her again at the nest, and feeding the chicks, at 10.14. There was no sign of the male, this last time, either by sight or sound. This does not, of course, prove that he had not flown in with booty, as on other occasions, but it hardly seems likely that the female would have preened herself in such a leisurely way before flying to him, had he been the occasion of her leaving the nest. I have established it that she does not always take what is brought in to her at once to the nest, but leaves it, or part of it, on the ground, should it be more than she has present need of, for future occasions. I think it very likely therefore that she, this time, procured something thus left or deposited. She did not, however, go down amongst the black rocks, where she yesterday left something that the male had brought.

At 10.55 the bird goes off the nest and I take a walk, returning and finding her still away (though I cannot, of course, tell how the interim has been occupied) in about an hour's time. She returns and takes her place, again, not bringing anything with her, at 11.25. At 11.32 she is off again, and at 11.40 I catch sight of the pair *in coitu*. The act was accompanied with the only different cry from that so often noted, which I have yet heard—a sharp, shrill monosyllabic utterance of no fulness or power, differing considerably from what I find it convenient to call the twitter, which is made up of a succession of little squeaks, but equally indicative of vocal poverty. The exigencies of the tent stop all further observation till 12.30 p.m., when I find the female bird on the nest. The sexual activities of these Merlins are thus seen in force, even in the midst of family cares; and although it must be now quite unnecessary, or even impractic-

cable, they seem to be attended with some disposition to build a nest.

At 12.50 p.m. the female quits the nest and flies to the ravine's edge, where, sitting on a rock, she alternately preens herself and stretches, for nearly ten minutes, then flies over the hill-side to a rock so far away, that, though I follow her on to it, she becomes then almost invisible—I just see her go up from it again and then lose both rock and bird. At 1.15, however, she comes flying back to near where she had before perched, and here she again sets to preening herself. She brings nothing with her and I surmise that her excursion has been an amatory one. After a while she goes up and flies from one place to another in the neighbourhood of her home, settling and preening herself, perhaps, a dozen of times before, at 1.41, she, at last, takes her place on the nest again. The chicks have thus been left for fifty minutes, in which time their mother might easily, one would imagine, have caught something for them, had she wished to, but she has returned without anything. It would appear, therefore, that, as with the Peregrine,* the division of labour, in the care of the young, has become so confirmed in this species that it can no longer be broken through—perhaps, however, I should only say that this seems probable.

Just after the bird takes her place, it comes on to rain, and it is not till it is clearing, though still raining, that she goes off again. As the flaps of the tent are now closed, except for a narrow aperture, I have to follow her flight with my unaided eyes, which, however, stand me in good stead, for I see her, when far down the slope, make the little dip down, and, at the same time, get an indication of the other bird. As before, having taken her rations, she flies on and I see her again alight, a good way beyond where she received them, but here she becomes indistinguishable from the brown stones about her. Her return to the ledge is preceded by a visit of the male to it, who, however, alights only for a moment, on the ledge, and

* 'The Peregrine Falcon at the Eyrie,' by Frances Heatherley, p. 63. Mr. F. H. Edmondson, writing in the 'Naturalist' for February, says, "Both kill, though the male mostly, the female only once." This is an interesting approximation to my own experience. A process of differentiation is evidently proceeding, which would admit of individual differences.

then flies to the other side of the gorge, where he stands perched. At 2.37 the female flies in and feeds the chicks, which takes her about four minutes. She then broods them, but at 2.55, or thereabouts, leaves the nest again, returning in two or three minutes, when she gives them a second meal which takes nearly twice as long. This last exit of the female took place when my eyes were closed for a moment or two, but when I opened them the male is still perched where he was before; it looks as though the hen had only brought a portion of what she received, and gone off for more.

I forgot to note that, some little time before this, whilst she was brooding the chicks, the female bird walked along the ledge, as on a former occasion, but, this time, right to the end of it, and began picking the green grass there with great spirit. It looked as though she were eating it, and though this may seem very unlikely, I certainly thought I saw her swallow a blade or two. Whatever she really did, when she had done it she made her funny little run back along the ledge to her chicks, and I then left her and made an ascent of the mountain, the characteristic features of which, with the lake in what is now probably part of an extinct crater at its top, I have already described. I return at 6.30, to find the female bird on the ledge, by the nest, and she shortly broods the chicks. About 7 p.m. the male bird flies up the gorge with his usual cry. The female flies out, but not to him, and there is no meeting either in the air or when he, shortly afterwards, perches on a favourite promontory. She flies on and returns, unladen, at three or four minutes past 7. At 8.13 she leaves the nest and flies briskly about, for a little, before again taking her place at 8.20. She seems impatient for the coming of the male, and when, a little past 8.30, he flies in, with his twitter, she darts off, to join him and is back with booty, and feeds the chicks at 8.35.

June 25th.—Owing to my oversleeping myself—which was owing to my lying recumbent rather than sleeping, for the greater part of the night, on account of my feet keeping cold and the ground hard, even through two Icelandic feather beds—I could make no observations this morning, other than that the female bird was on the nest, before Sigurdsson's arrival with the ponies ended this monograph and ushered in the return journey.

“Which-ee, which-ee, which-ee, which-ee, which-ee, which-ee-which” or “Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit”—one of the two, or between the two, and so on, at intervals of from five to ten minutes, perhaps. It is the cry of the Whimbrel when actuated by some definite idea, not always clearly apparent. Beware of forming a theory that the bird, as it walks, saying this, says it only at the top of each little tussocky hillock with which the sopped ground is quite dotted, for, if you do, it will fail you sooner or later, and the cry go up from the valley, this or that one being skipped and passed unmelodiously over. Still, speaking generally, these Whimbrels seem to like thus to pipe from the vantage, as it were, of one of the low eminences they so constantly move amongst. This particular one I am watching, now, at length becomes stationary, thus posted, and for ten minutes or a quarter of an hour, perhaps, or even longer, continues perseveringly with its witless, monotonous, yet ever pleasing little “Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit.” Then, at length, from somewhere in the nearer middle distance, comes a “tor, tor,” as though fraught with warning and—to a quick response of “Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit”—another Whimbrel rises on the wing. The first at once follows suit, like brown shadows the two come flitting to each other, and from both together goes up, now, the “Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit.” Then they wheel away from each other. One goes down some way off, and is silent, the other—surely the one I have first had under observation—flies back, sinks shadow-like, walks, with precise little steps to his old or some close-joining hillock, mounts it, and goes on with his “Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit.” It would seem now that there ought to come another grave “tor, tor” (or has the danger been averted?), but there never does, nor any other note or cry—not even the classic one—from the late-appearing bird, at least whilst I have the patience to wait. But the other stands ever on his hillock, and still, at moderate intervals, says, “Wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee, wit-tee-wit.”

(To be continued.)

A CATALOGUE OF THE LAND AND FRESHWATER
MOLLUSCA OF SUSSEX.

By E. W. SWANTON.

(Member of the Conchological Society; Curator of the Educational Museum,
Haslemere.)

A PAPER under the above title by J. E. Harting, F.Z.S.,* was published in the 'Zoologist' in the spring of 1878. Ninety-four species were enumerated, but no allusion was made to varieties. The sources of information at Mr. Harting's disposal included William Borrer's MS. List of Sussex Land and Freshwater Mollusca, Weaver's account as given in Gordon's 'History of Harting,' and W. C. Unwin's "List of Lewes Mollusca," which appeared in the 'Naturalist' in 1853.

During the past thirty-seven years our knowledge of the molluscan fauna of the county has increased very considerably. Numerous papers and notes have appeared from time to time in various scientific periodicals, including the 'Journal of Conchology,' which published William Jeffery's authenticated list of the Land and Freshwater Mollusca of Western Sussex (1882), J. H. A. Jenner's paper concerning East Sussex species (1891), and East Sussex records by William Whitwell (1900-1903).

If we include post-Tertiary forms now extinct in Britain, some thirty species have been added to the Sussex list since the appearance of Mr. Harting's paper, and about one hundred and sixty varieties have been recorded. The need of a revised and extended catalogue is thus very evident. By way of introduction to the same, some comments may be given upon certain points of special interest.

NEW SPECIES.

Of recent additions to the British list of inland Mollusca, *Helicella heripensis*, *Planorbis vorticulus*, and *Valvata macrostoma* have been found in Sussex. It may be noted, though, concerning

* Editor of the 'Zoologist' at that time.

this trio, that, failing anatomical differences, they are probably only varieties of well-known species. *Helicella heripensis* is apparently very near to the variety *gigaxii* of *H. caperata*; *Planorbis vorticulus* is perhaps an almost keel-less form of *P. vortex* (it had been recorded from Pleistocene deposits in the county some years before it was discovered in the living state); and *Valvata macrostoma* is still considered by some authorities to be identical with the variety *depressa* of *V. piscinalis*.

LUSITANIAN ELEMENTS.

Animals and plants which are supposed to have reached Britain from the Continent by land connection to the south-west of Ireland in Miocene times constitute the so-called Lusitanian element of our fauna and flora. Dr. Scharff remarks that though we have a good many species of Lusitanian origin in the British Isles, yet "we have only a mere remnant of what we ought to have, had the climate been less trying. . . . That the Lusitanian fauna is very ancient in the British Islands is proved by the fact of the discontinuous distribution of so many species. A greater number survived in Ireland than in England." *

In Sussex the Lusitanian elements of our molluscan fauna include *Helicodonta obvoluta*, which still lurks in the recesses of the primeval woodland tracts on the slopes of the Downs and in ancient parks; *Helicella cartusiana*, another downland species occurring in isolated colonies; and *Hygromia fusca*, a woodland species of great rarity. There are indications that these elements are waning. Dead shells of *Helicodonta obvoluta* occur in spots where repeated search has failed to yield the living animal. *Helicella barbara* (= *Helix acuta*) at one time flourished at Mill Gap, Easebourne, but is now extinct there. Three specimens of *Helix pisana* from the collection of the late Frederick Townsend, F.L.S. (now in the Haslemere Museum), are said to have been found in Sussex about the middle of the past century; further evidence of the existence of this species in the county is very desirable. Precise information concerning the distribution of *Helicella cartusiana* is needed; the records appear to indicate that it is dwindling.

* 'History of the European Fauna,' p. 307.

Testacella is a Lusitanian genus represented in Sussex by two species—*T. haliotidea* and *T. scutulum*; but as in both the records appear to be in connection with cultivated ground, they may possibly be modern introductions. The latter was brought to Chichester thirty-four years ago.

METHODS OF DISPERSAL.

The molluscan fauna of the so-called “dew ponds” on the South Downs has been investigated by Mr. Clement Reid, who contributed, in 1892, a most interesting paper “On the Natural History of Isolated Ponds” to the fifth volume of the ‘Transactions of the Norfolk and Norwich Natural History Society.’

These ponds are depressions puddled with clay, and used by farmers as water reservoirs; they are maintained by mist, fog, and rain, the dew supply being quite inconsiderable. They usually teem with animal life. Mr. Reid observes that “they are distant two or three miles from the nearest stream or marsh; and as the Downs rise to 800 ft., and the average height is fully 200 ft. above the highest streams, it follows that any aquatic animals or plants found in the ponds must have been transported uphill, as well as across uncongenial tracts of dry grass.” *Limnæa pereger* is of common occurrence in these ponds. In the summer of 1891 the writer noted that the pond near Chanctonbury Ring was teeming with them.

Mr. Reid alludes to “Red Lion Pond on the open Down, three miles south-east of Lewes; height 540 ft. above the sea, and 530 ft. above the marshes of the Ouse; nearest water, the marshes of the Ouse, distant seven furlongs.” In June, 1890, he observed *L. pereger* in it. He also remarks that in a “small pond by the side of the high road, half a mile west of Christ Church, Stansted (near the Hampshire border), height 312 ft. above the sea, and 220 ft. above the nearest stream,” he noted *L. pereger* and *Planorbis spirorbis* on September 25th, 1891. Other species occurring in “dew ponds” are *Limnæa truncatula*, *L. stagnalis*, *Planorbis vortex*, *Physa fontinalis*, *Pisidium pusillum* (occasionally), and *Sphaerium corneum*.

The ancestors of these Molluscs were in all probability carried up to the ponds on the feet of birds, or on large water insects. Mr. Chapman records in the ‘Field’ (1884) that he shot a Snipe

at Rye with a *Sphaerium corneum* fastened to the hind toe. He noted that the bird was sailing "with apparently a leg down." The foot and shell were placed in the British Museum. Numerous records from other counties of transmission of water Molluscs by birds may be found in Mr. Wallis Kew's 'Dispersal of Shells.'

Land Molluscs may be carried from place to place by similar agencies: witness a comparatively recent observation in Sussex. Mr. H. J. Stalley records in the 'Journal of Conchology' (April, 1911) having found in a lane near Upper Beeding "a huge Bumble-bee with one of its hind legs held firmly between the shell and the operculum of a fine specimen of *Cyclostoma elegans*; the Bee was only able to progress in a series of short flights, rising about two feet in the air, and then being dragged down again by the weight of the Snail, reaching the ground in each case some four or five feet from its last resting place."

Man has played and will continue to play no insignificant part in the dispersal of Molluscs. Probably in the majority of English counties enthusiastic conchologists have brought living Snails from considerable distances and turned them down in spots where they had not previously been observed.

Testacella scutulum was introduced by Mr. W. Jeffery in 1881 into his garden at Ratham, Chichester, from Newport, Isle of Wight. Specimens were collected from the garden in June, 1889, and probably it continues to flourish there.

Weaver, writing of *H. pomatia* in Gordon's 'History of Harting,' remarks that "a tender solicitude for the length of our catalogue of natural productions has induced us to import some fifty or sixty specimens of this fine Snail into the parish. These were obtained from Preston Candover, where about thirty years ago they were plentiful, and we made an impartial distribution of them between Padswood Copse, the Warren, the hedge-rows on either side of Love Lane, and Lever's Copse at the foot of the Fore Down; but the experiment to establish them here signally failed; we never saw one of them afterwards." Weaver attributes their extermination to Hedgehogs.

Mr. W. Jeffery unsuccessfully attempted to introduce (*circa* 1868) this species into his garden and adjacent bank at Ratham, near Chichester.

The Rev. W. A. Shaw turned down some Northamptonshire

specimens of *H. pomatia* in a chalk-pit on the Downs near Kingley Vale in September, 1909, but has not visited the spot since.

Instances of the introduction in ballast of Molluscs into certain districts in Sussex during the construction of a railway are quoted by Mr. Wallis Kew (*op. cit.*, pp. 197-198):—" *Helix virgata* found plentifully on embankments between Pevensey and Bexhill, where the London, Brighton and South Coast Railway runs close to the sea, was probably brought, as the Rev. S. Spencer Pearce states, with the chalk forming the embankments, which is believed to have come from the Eastbourne cutting, some eight or nine miles away; the same Snail, according to another observer, noticed in several places on railway banks, also in Sussex, 'was probably brought with chalk'; a colony of *H. cartusiana*, also, known to have existed for some years at Cowfold, in the same county, and now extinct, is believed to have been originally introduced with chalk. *H. virgata* . . . established in gardens now disused and weed-grown, around some of the Martello Towers in the midst of the broad shingle beach, which, of course, is destitute of terrestrial Molluscs, between Eastbourne and Hastings, was probably introduced, Mr. Pearce suggests, with the chalky soil of which the little plats were formed, or it may have been carried thither with garden plants."

ASSOCIATION WITH LOCAL ARCHAEOLOGICAL REMAINS.

Mr. Herbert Toms, in a paper entitled "Rough Notes on Land and Marine Shells associated with Local Archaeological Remains," read before the Brighton and Hove Archaeological Club in April, 1912, raises the interesting question whether *H. nemoralis* was eaten by prehistoric peoples. He had noticed large numbers of bleached shells associated with Roman and British pottery in the mole-heaps covering the tops, slopes, and bases of ancient cultivation balks near Brighton, on spots that are now devoid of furze, and had ascertained subsequently that Lt.-Colonel Pitt Rivers had noted similar shells in excavations at Cissbury, Caburn, and Seaford Camps. I am indebted to Mr. Toms for detailed notes concerning the shells observed at these camps, and here append a summary of them.

A section had been cut through the ditch and rampart at Cissbury, and during the cleaning out of the ditch Pitt Rivers found that it had been dug through the filled-in shafts of several of the old Neolithic mines. In the filled-in ditch he noted shells of Oysters and large Snails in the upper layer, shells of sixteen Oysters, two hundred large Snails, and about two hundred *H. nemoralis* in the second layer, and a number of shells of Oysters and *Cyclostoma elegans* in the third layer. Near the bottom of one of the filled-in Neolithic shafts a skeleton was found, together with a lot of animal bones mixed with quantities of shells of *Helix nemoralis*. (It would be interesting to know if these shells were bored.)

In the early British pits and camp on Mount Caburn, near Glynde, Oyster shells were present in the surface mould of the pits, but in no case was a single Oyster shell or a shell of *H. aspersa* found in the filling-in at the bottom; but shells of *H. nemoralis* were found in great abundance all through the pits, and in one of them a layer occurred just below the turf. Quantities of *H. nemoralis* shells were found near the bottom of the entrenchment ditch, and in some pits they were associated in considerable numbers with those of Oysters, Periwinkles, and Cockles, also bones of various domestic animals.

At Seaford Camp (pre-Roman) Pitt Rivers noted quantities of Oyster and Limpet shells in the mould capping the ditch, but not lower. Two feet below the surface a Whelk shell was found in association with a considerable number of shells of *H. nemoralis* and *H. hortensis*.

Shells of *H. nemoralis* and *H. hortensis* have been found by Messrs. J. R. Mortimer, H. Toms, and others in connection with ancient encampments in other parts of England, but the notes given above are sufficient to indicate the interest that attaches to the question raised by Mr. Toms. The evidence, as it stands at present, rather points to the intrusion, in many cases, of the shells into the pits and ditches by natural agencies. It must be remembered that *H. nemoralis* is a common Mollusc on the Downs, and during the gradual silting-up of the pits and ditches their shells would become intermingled in some numbers with the earth. Their occurrence, however, in such large numbers in the middle layer at Cissbury gives strong support to Mr.

Toms's suggestion, and we must not overlook the fact that *H. nemoralis* is eaten at the present day with much relish in many Continental countries, and in some districts is even considered to have a more delicate flavour than either *H. pomatia* or *H. aspersa*.* It is therefore only reasonable to suppose that this Mollusc was eaten during hard times, if not regularly, by the primitive occupants of the Sussex Downs. Mr. Toms does not claim to have established his point, but there is much to support it, and it merits careful investigation. Since writing the above, the Rev. W. A. Shaw informs me that *H. nemoralis* was found in British middens excavated on Stoke Clump in 1910.

FOLKLORE.

There are two interesting observations by Mr. Weaver mentioned in Gordon's 'History of Harting' that deserve quotation here. On p. 319 he observes that *H. ericetorum* is "the common Snail of our Downs, and is often put in requisition for decorative purposes by our tender-aged rustic beauties, who mount a number of the dead shells as necklaces and bracelets by stringing them together." This appears to be a survival of a very ancient practice, and one would much like to know if bored shells have been found on prehistoric sites in Sussex.

On p. 312 Weaver writes concerning *Arion ater*:—"By many persons of easy belief, this Slug is thought to be endowed with a valuable property, in which may be found a slight compensation for its depredations. In the destruction of warts on the human skin, it has the credit locally of having been eminently successful long before the application of acetic acid to this purpose. The living Slug, after having been carefully rubbed over the parts affected, is to be securely impaled on a thorn in some secluded place and there left to die. If, from the commencement of the experiment, the warts do not gradually become fine by degrees and beautifully less, until they finally disappear, the operator has failed in one or other of the two conditions indispensable to success—implicit faith or strict secrecy!"

(To be continued.)

* Notes on *H. aspersa* in association with archæological remains, and on its use as food at the present time in parts of Wilts and Somerset under the name of "wall-fish," may be seen in my papers on the Mollusca of Wiltshire ('Journal of Conchology,' 1908) and the Mollusca of Somerset ('Somersetshire Arch. and Nat. Hist. Soc. Trans.,' 1911).

CRITICAL NOTES ON SOME STATEMENTS OF
NEWTON ON BIRDS.

By E. P. BUTTERFIELD.

NEWTON's work is a *magnum opus* indeed, and I am frank enough to confess that such a work, involving such a combination of qualities, could not have been written by any other living man; but whilst recognizing this fact, one can have no hesitation in affirming that the weakest portion is that relating to observations of field naturalists.

Birds differ much in their habits, and what is true of one species in one locality may not be accurate in another, even when such localities are not wide apart, and the observations which I have made below, I am quite willing to admit, may be challenged by the observations relating to other districts; but, whilst admitting this, I cannot help but think that some of the observations of Professor Newton in his monumental work are much too sweeping in their character, and will have to be modified in any future edition.

Newton, after alluding to the male of the Blackcap (*Sylvia atricapilla*) sharing with the female the duty of incubation, refers to writers who have declared that the male whilst so employed has been known to sing—"a statement," the Professor adds, "that seems hardly credible." I do not know on what ground he wishes it to be inferred that he disbelieves the statement, but I am very much mistaken if I have not heard the male sing, not perhaps his best song, but somewhat insouciantly, whilst in the act of incubation.

Cuckoo (*Cuculus canorus*).—Its arrival, Newton says, is at once proclaimed by its song, which is confined to the male sex. Contrary to these statements I have frequently known the Cuckoo after its arrival to be exceedingly reticent, and I have good grounds that, occasionally at least, the female does utter the well-known cry popularly attributed exclusively to the male

sex. The appearance of the Cuckoo, Newton further states, is a signal "for all the small birds of the neighbourhood to be up in its pursuit, just as though it were a Hawk, to which indeed its mode of flight and general appearance give it an undoubted resemblance." In this district and many other districts I have visited, especially in the neighbourhood of vast moorlands, the Cuckoo is not much mobbed nor harried by a great variety of small birds, other than the Titlark, this being the species which is most victimised by the Cuckoo in such districts. I hardly think that small birds mistake the Cuckoo for a Hawk; indeed, their behaviour in the presence of the Cuckoo is altogether different from their behaviour in the presence of a Sparrow-Hawk, and the mode of flight of the latter species is quite unlike the Cuckoo's. When the Titlark is in the presence of the Cuckoo, it evinces more curiosity than fear.

Newton dismisses as a vulgar and seemingly groundless belief the idea that Cuckoos suck the eggs of other kinds of birds, but the accumulated facts in presumption of this habit hardly warrants him in dismissing this subject in such a summary fashion. This habit, however, may be chiefly confined to the female, and to those nests into which it foists one or more of its own eggs. When the Cuckoo introduces its egg into the nest of its dupe, one egg of the fosterer almost always mysteriously disappears; and I have never known the nest in which two eggs of the Cuckoo have been laid to contain the full complement of eggs of the fosterer.

Referring to the Spotted Flycatcher (*Muscicapa grisola*), Newton writes that this species is one of the latest of our migrants, which is quite accurate, but he goes on to say that it seldom reaches these islands before the latter part of May. Even in Yorkshire it not unfrequently arrives at the end of April, and is here usually in full numbers by the middle of May.

Writing of the Pied Flycatcher (*M. atricapilla*), it is said that this species is more numerous in the Lake District than elsewhere in England, but I am not quite so certain whether it is not more numerous in some parts of Yorkshire. Newton does not mention its occurrence in Wales, but in some parts of the Conway Valley I have found it more numerous than in any other part of the British Isles.

The Grouse (*Lagopus scoticus*) is rarely or never found away from the heather on which it chiefly subsists, so says Newton; but in severe winters it is not an unfrequent occurrence to see them at quite a considerable distance from the moors.

It is not at all certain whether the Kestrel is quite such a harmless bird as is to be inferred from Newton's book, though there can be no hesitation in confirmation of the statement that this species is quite the most harmless of all the Accipitres.

Contrary to the statement of Newton, the Sky-Lark (*Alauda arvensis*) is much more partial to grassland than cornfields for breeding purposes, and the statement that it rears several broods in a season is open to question. Five eggs is a clutch which must be rare in this part of Yorkshire; abundant as this bird is—probably the most abundant of British birds—its present status can by no means be assigned to its excessive fecundity.

The Linnet (*Linota cannabina*) can scarcely be said to feed largely, if not especially, on seeds of plants growing on heaths and commons, but chiefly on seeds grown in the more cultivated parts of the country, sometimes far away from its breeding haunts, the dandelion seed perhaps being its most common food; other seeds, such as the plantain, sorrel, knapweed, furnish this bird with a perennial supply throughout the summer months.

Whether the Twite (*L. flavirostris*) replaces this species either partly or wholly may be a moot point, but the breeding haunts of the Twite would seem to be at a much higher altitude. Indeed, the Linnet, other things being similar, seems to affect during the breeding season moderate altitudes.

The Common Sandpiper is said by Newton to arrive in May, but would it not be more accurate to say *April*? The Professor thinks that it hardly exceeds in size a Sky-Lark, but it always strikes me as decidedly larger, but I would not be dogmatic on this point.

The Sand-Martin is said to have several broods in the year, which is contrary to my experience. I should scarcely think that a very large proportion have even two broods in a season. In its departure it is more regular, as Newton says, than other *Hirundinidæ*, and leaves earlier.

The Nightjar (*Caprimulgus europæus*) does not always perch on a tree lengthwise, for sometimes I have seen it perch in the

ordinary way, and in this neighbourhood it nearly always, if not always, lays its beautifully mottled eggs on the bare ground, not generally where the herbage is short, as stated by the Professor. He further adds that the site chosen for the nest one year is almost certain to be occupied the next; but although this species shows great local attachment in its nesting-site, I have never found the nest in the precise site for two years in succession.

Under the head of Water-Ousel (*Cinclus aquaticus*) it is not at all certain that the Professor's remarks are in accordance with his usual courtesy, when those who think that this species may be guilty of feeding on the spawn of fishes are accused of being careless and ignorant.

Alluding to the habits of the Ring-Ousel (*Turdus torquatus*), it is said that it shuns "woods, groves, and plantations," but I have found its nest twice built in trees in plantations.

A NOTE ON PARASITIC KERONA.

BY THE REV. H. VICTOR-JONES, F.Z.S.

THE psychical life of the Protozoa has always been a puzzle to the biologist. A puzzle because, so often, into the play of life of these microscopic animals there enters an element which controls the action and mode of persisting of each individual organism, and this element defies classification.

The question is still in abeyance as to whether the series of effects constituting the life-history of these lowly organisms is merely and solely a chemical stimulus and a mechanical response, or whether we ought to bring in the incipient germs of "knowing"—of intelligence. Kerworn, after tremendous labour, came to the conclusion that the Protozoa do not show the slightest trace of intelligence. Jennings, too, thinks that their life is a series of "trial and error." But these assumptions are still far from satisfying, and with many noted biologists we concur in the statement "that after all we must not dismiss the possibility that in the possession of these lowliest of the low there may be the slightest vestige of the proto-psychic power of analyzing the causes thrust upon them, and which bring out the decidedly problematic effects constituting the life of the unicellular organism."

The greater number of Protozoa are parasitic, and we can easily understand why many types have, each, their own peculiar and particular type of host, but there are other cases which seem to demand that we stipulate to the parasite a certain amount of control over circumstances. The psychical life of the lower types is as yet so little known that it is, indeed, unwise to dogmatise upon the process of "living" among such as merely the method of "trial and error."

Some twelve months ago, while examining a specimen of *Hydra viridis*, which had been obtained from some duck-weed (*Lemna*) growing in a rather stagnant pond, I was interested to

find that it had fifteen tentacles instead of the usual number possessed by this species, namely, six to ten tentacles. Interest was further aroused by the movements on the surface of the coelenterate of eleven protozoal parasites. When the high power was brought to bear upon the organisms, it was found that eight were wandering over the outside of the *Hydra*, while three were quite at ease inside the body cavity—apparently wandering aimlessly over the endodermic cells.

The parasites were all of the same species, and were identified as *Kerona polyporum* :—

Description.—Müll., Ehr. Genus of infusoria of the family Oxytrichina.

Characters.—Body covered over with cilia, hooks present, but no styles. Body flat or depressed, whitish, elliptico-reniform with a row of longer cilia in front of the mouth; length approximately 1-144".

These eleven parasites were found on and in *Hydra viridis*, while it is stated by many that the host is confined to the species *H. fusca* and *H. vulgaris*. Thus we see that the limit is too narrow, and that the range stretches over and includes *Hydra viridis* as an occasional host of *Kerona*.

It has also been generally understood that *Kerona* is an ecto-parasite, found only on the outside of *Hydra*, yet here three were in the body cavity. For ten days the *Hydra* and parasites were kept under observation. The ratio during that time still remained the same, eight remaining on the outside and three occupying the coelomic cavity, all exhibiting the usual apathetic attitude of parasites in general; namely, they were entirely indifferent to movements of the host, wandered at leisure over the surface, living probably by osmotically absorbing the nutriment found in connection with the host. The water in which they were kept during these ten days was well supplied with Entomostraca and other food-supply for the *Hydra*.

One of the *Kerona* divided on the fourth day. Thus the ratio was nine outside and three inside. After the tenth day no food was supplied, and to one's astonishment on the twelfth day many of the external parasites were found to have made their way into the coelomic cavity; and from this time on, the

parasites were equally at home outside or inside, and simply wandered in and out with ease and safety.

This observation causes us to wonder whether it was the lack of food-supply outside which caused the external parasites to make their way inside the body cavity, where certainly the supply of food juices would be richer. If this suggestion be correct, then the *Kerona* must have at their disposal a "something" which we have no ground for calling "intelligence," but still a "something" which enabled them to become aware that the coelomic cavity was richer in food material than the outside, and they consequently made their way to the richer grounds.

But if we, on the other hand, rule out this possibility and claim it to be chemiotaxic stimulus, then we are in a quandary as to why this stimulus did not come within the first few days when the difference in strength between the juices inside and outside was as great as it was when the apparent stimulus did come.

Another fact which this observation brings out is this, that *Kerona* must not rigidly be classified as an ecto-parasite; for we have seen that for about fifteen days three of the parasites were endo-parasitic in habit, and entirely immune from the deleterious effects of the gastric ferments which dissolved and killed other organisms stronger and larger than *Kerona*, for example, *Daphnia* and small annulata.

Besides, after the tenth day ecto-parasites became both ecto- and endo- in habit. Therefore *Kerona* must not be classified as rigidly confined to the species *H. vulgaris* and *H. fusca*, nor to the endo-parasitic class alone, but also to the ecto-parasitic.

Moreover, should *Kerona* be classified as a parasite in the true sense? It rather comes under the class of Commensals, where some mutual benefit is derived. Can it be that the *Kerona* has some part in cleansing the *Hydra* from foulness? *Kerona* being almost always found on *Hydra* which inhabit stagnant ponds. If the *Kerona* is to be reckoned as a parasite, why should the *Hydra* not rid itself of the irritating depredator by means of its powerful stinging nematocysts? Instead, the *Kerona* wanders inside and outside, over and around the trigger-hair or cnidocil without causing the nematocyst to shoot out. Neither do the amœboid digestive cells inside envelop the internal ones

in a similar way to that which they do when purely foreign organisms are engulfed.

Has the *Hydra* a spark of intelligence?—or is it mere chemical stimuli?

The first explanation seems high, but the second certainly too low, and here we are compelled to leave the psychical life of the lower organisms and those happenings in their lives which suggest control, and say with Professor Thompson, “that there is no reason why any evolutionist should doubt that they have in them the indefinable rudiments of mind.”



Kerona polyporum (parasitic on *Hydra*).

OBSERVATIONS UPON THE BEHAVIOUR OF A CAPTIVE ROCKLING.

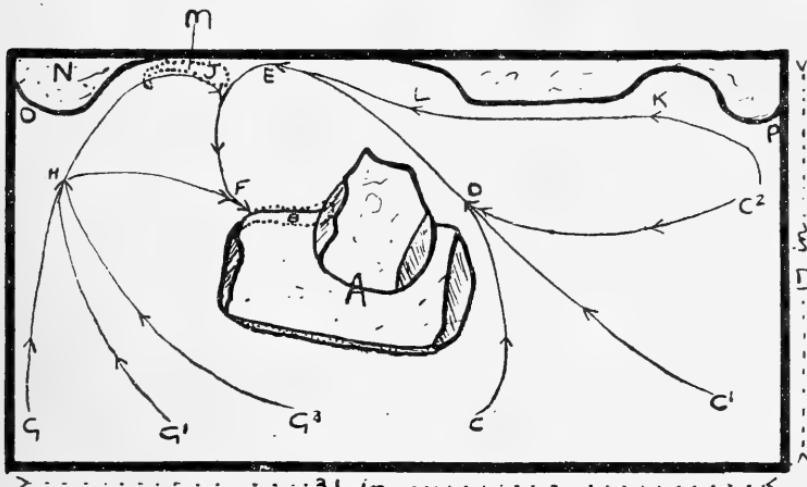
By H. N. MILLIGAN, F.Z.S.

THE Five-bearded Rockling (*Motella mustela*) which is the subject of this article was obtained by me at Walton-on-the-Naze on December 3rd. I did not watch the movements of the fish with any particular care during the first week or ten days of its residence in an aquarium at the Horniman Museum, and the following remarks must therefore be understood to refer to the time subsequent to the first ten days of its captivity.

A plan of the aquarium in which I placed the Rockling is given in the accompanying figure, the back and two sides of the tank being of dark blue slate and the front of glass. The fish made its resting-place beneath and behind the shelving rock lettered A, which stands nearly in the middle of the floor of the aquarium, in the position shown in dotted outline B. Except when tempted to follow pieces of raw beef (which it will seize and swallow very readily) held close before its snout in wooden feeding-forceps, the Rockling did not seem to care to leave this place in the daytime, and I have only twice seen it do so voluntarily. In the night, however, it wanders freely. I have visited its tank after dark with an electric hand-lamp, whose light I could turn on and off at will, and have observed that the fish searches and researches every part of the aquarium, and that its movements have a vigorous and determined character not displayed in the daytime. I often find in the morning that the pebbles on the bottom of the aquarium have been disturbed in a way which shows that the fish has ploughed through and through them with its heavy body during the night. The average size of the pebbles is about that of a hazel-nut, so that the Rockling must use considerable force in shifting masses of them.

The fish almost invariably lay in its resting-place B with its tail directed towards the left side of the tank. During its first twenty-one weeks in the tank, I can only remember four

occasions on which I saw it lying with its tail directed towards the right. When tempted with a piece of beef to come out, say, to the point C, or C 1, or C 2, it would seize the food, and then swim back past the corner of the rock A, along the course C D E F, indicated approximately by arrows on the plan.



Plan of Aquarium to show the Resting-places and Routes of a Captive Rockling.

From C to D it would not swim quickly, but when it reached the back of the aquarium at about the point E, it would suddenly hasten its movements, and turn and dart with great rapidity along the course E F to its resting-place at B. The point I desire to emphasize is that, if the fish, in returning to its hiding-place, reached a part of the aquarium to the right-hand of the rock A, it would then *usually* take the course C D E, but *always* moved first to E, and then suddenly quickened its movements to pursue the course E F B. When returning from a part towards the left-hand side of the aquarium, say from G, or G 1, or G 2, it would usually take the course along G H J F to B, turning quickly at J to dart through F into its resting-place, though I have seen it occasionally go from H directly through F to B. Sometimes it would pass from the region of C 2 through K L to E.

I am not quite sure how long the Rockling had been in the aquarium before my attention became fixed upon this habit, but probably about three or four weeks. I then repeatedly tempted

the fish with beef to come out, in order that I might watch the course it took in returning home. What is the explanation of this curious behaviour in following a certain course and then changing it and darting suddenly home? Is it merely an idiosyncrasy of this fish, or a characteristic habit of Rocklings in general? Is it, as I am inclined to believe, an instinctive attempt of the Rockling to mislead possible enemies as to the real position of its resting-place? It will be observed, on looking at the plan, that in the region of E the dark slate at the back of the aquarium is not covered with rockwork (though it is covered above the level at which the plan is supposed to be taken). I thought at first that perhaps this nocturnal fish, when it had secured some food, instinctively directed its retreat towards the dark patch, and this idea may have already occurred to the mind of the reader. But this apparent explanation is shown to be wrong, when it is remarked that the aquarium is in a dark place (lighted when necessary by an electric lamp from above), and that the corners O or P would have been as likely to attract such a poor-sighted fish as the Rockling. Again, why should its speed be greater when it was making the turn from E or J than at other times, or why did it not creep round the rock A to reach B, as one would have expected it to do, instead of passing across the open water between D and E?

On March 23rd (*i. e.* about sixteen weeks after introduction of the Rockling) I put several Common Gobies into the aquarium. The largest Goby was about three and a half inches in length, or about half the length of the Rockling. Immediately the Gobies were dropped into the water they darted away into holes and crevices in the rocks, and when one of them dashed into the place where the Rockling lay, the latter seemed so much alarmed that it at once quitted its hiding-place and took up a position (shown in dotted outline at M) at the foot of the vertical rock N at the back of the tank, with its tail slightly curved, and its head directed towards the right and looking somewhat towards its old hiding-place. In this position, or nearly in this position, in which it is much exposed to view and to the attacks of enemies, if there were any in the tank, it remained, lying almost motionless, at least in the daytime, up to May 1st. If it moved at all in the daytime, it was only for an inch or so towards the right and

then back again. It will be observed that the place it had taken is on a part of the old route from H to J. There are places amongst the rocks covering the greater part of the back of the tank in which the Rockling would apparently have been safer than, and not so conspicuous as, it was in the position which it had taken up, though there is no hiding-place which seems so suitable for it as the one it had at first. It still pursued parts of its old courses, say from C to E, or G to J, but I do not think it did so with quite its former confidence. I observed no sign that the Rockling was making fresh courses to M of a kind likely to mislead possible enemies as to the real position of M.

The loss of its first hiding-place had one curious, and somewhat ludicrous, result. When it had seized beef, which I had induced it to follow, the Rockling, for the first few days, would sometimes dart back along one of its old courses to its former resting-place, and then instantly rush out again in terror when its snout touched the Goby in possession. It appears that the lesson learned so thoroughly in sixteen weeks required some few days to unlearn.

On the morning of April 17th I became aware that the Rockling had formed a new habit. When the food of the Gobies, which consists of fragments of raw beef, was dropped into the aquarium, the Gobies began excitedly to dart out of, and into, their hiding-places, and at first the Rockling shrunk timidly against the wall when a Goby dashed past it. The Rockling was fed last, because unsatisfied Gobies were apt to snatch the food from its mouth. The sight of the Rockling is very poor, and food was therefore placed close to its head. On the 17th I noticed that when the Gobies began to scurry about the aquarium the Rockling showed unmistakable signs of interest, and after a moment or two began to swim as though seeking food. Its behaviour at feeding time (then and since) suggested that in the twenty-five days during which the Gobies had shared its aquarium the Rockling had come gradually to associate unwonted activity of the Gobies with the advent of food. By May 1st the Rockling had become so used to the Gobies that it had begun to lie, along with one or two Gobies, in or close to its old resting-place (but with its tail directed often to the right), and to resume its old courses, though not with its former precision.

NOTES AND QUERIES.

AVES.

Parrot Learning by Experience.—A Yellow-naped Amazon in our possession was climbing on the wire supporting a pendant of five small electric lamps, and bit it through, getting at any rate a fall, and possibly a shock. Since this experience, she will not touch anything in the shape of a cord or string, let alone trust herself on a pendant wire.—W. CROSS (Aldgate).

Sense of Direction in Birds.—In reply to Dr. Dewar's note ('Zoologist,' xix. p. 156), my assumption as to the Polynesian Cuckoo is identical with that of the late Prof. Newton. Of course, the whole difficulty lies in the fact that the young British Cuckoo's *first* journey is *not* a return journey. Until our theories as to the sense of direction in birds can solve this young Cuckoo problem, they afford no assistance to a "nonplussed" student of migration like myself.—RICHARD M. BARRINGTON (Fassaroe, Bray).

Hermaphrodite Fowl.—Some years ago I received a Fowl which, when cleaned, proved to have male organs about the size of kidney beans, besides an ovary with eggs as large as peas. It was forwarded to me already plucked, so I cannot say what the plumage had been like, but noticed it had one leg black and the other white. My foreman saw it as well as myself, and noticed the peculiarity in the sex organs. I have also had Herrings with hard and soft roes.—F. H. BROOKS.

Blackbird's and Robin's Joint Nest.—When the tenant of a cottage here was cutting the ivy on it, he uncovered and removed the nest of a Blackbird, which flew from the nest when the ladder was put up. The nest is an ordinary Blackbird's nest externally, but has an added lining of hair, moss, and decayed vegetable matter, such as a Robin uses. It contained four Blackbird's and two Robin's eggs. One of the former was afterwards broken, and found to be a good deal incubated; the Robin's eggs appeared to me to be fresh. Probably the Robin added the lining during the laying period when the Blackbird was off the nest; but apparently she must have managed to lay her two eggs during the incubation period. And in that case, as she

could not have sat side by side with the Blackbird, she must have watched for an opportunity when the Blackbird was off to feed. The Blackbird was known to be building somewhere in the ivy, but the Robin had not been noticed.—O. V. APLIN (Bloxham, Oxon).

Black-cheeked Love-birds Nesting in Cage.—A pair of Black-cheeked Love-birds (*Agapornis nigrigenis*), kept last autumn in a cage about three feet six inches square in the bird department at Messrs. Gamage's, nested in a cocoanut husk and laid eggs. They did not sit, but as the cage was only about five feet from the floor in such a greatly frequented establishment, the fact of such a nervous species as a Love-bird nesting in public at all seems to me sufficiently notable to be worth recording.—C. T. NEWMARCH.

Return of Summer Migrants to Old Haunts.—On April 29th we saw the first Turtle-Dove, and from its actions there can be no doubt that it is one of the birds which frequented our garden last year. It came at once to a place near the front door, where the waste seed from the bird-cages is thrown out, and in every way behaved like a bird which felt entirely at home. Another has joined it, and both allow one to watch them at about twenty yards' distance. We have watched Turtle-Doves here for over twenty years, and they have often become fairly tame as summer advanced, but these birds in early May are much more like those which come to the garden in July. My daughter, who lives a few miles away, is quite sure that a Cuckoo she heard last year has returned; she has a good ear for music, and at once recognized a curious fault in the second note of the song. For my own part, I feel as sure of the return of these migrants as if they had been "ringed birds recovered."—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds).

"Paget's Pochard" at Kew.—There are at present to be seen on the pond at Kew two drakes like that figured in Stevenson's 'Birds of Norfolk,' vol. iii. pl. iii.; their eyes, however, are distinctly yellow. They are full-winged, and, I hear, were bred here between a male White-eyed and female Common Pochard, thus confirming the origin attributed to this bird by Stevenson and others. A female, almost exactly intermediate between the two species mentioned (which the males are not), appears to be their sister.—F. FINN.

Colour-change in soft parts of Birds of Prey.—I notice that in the Bateleur Eagles (*Helotarsus ecaudatus*) in the Zoo the red of the bare face and the feet, which becomes most intense when the bird is indulging in its curious display and song, with raised but unopened

wings showing the white lining contrasted with the black head and breast—in which position it might well serve as the Prussian Eagle wearing the German colours and howling the "Hymn of Hate"—becomes, on the other hand, much paler when feeding, the face turning yellow and the feet brick-red or even flesh-colour. The sight of food at a distance will cause this change to begin. Similarly I saw in two Caracaras (*Polyborus brasiliensis*), which were from their movements apparently courting, with thrown-back heads and reiterated cries, that the face was yellow, instead of pale red, as it often is in this bird, and was in some quiescent adjoining specimens. In a Pileated Vulture (*Necrosyrtes pileatus*), however, in the Zoo some time back, the bare face, livid fleshy-white ordinarily used to become brilliant rose-pink, contrasting with the bluish eyelids, as the bird hopped about in the scramble at feeding-time. The legs in the last two birds do not change.—F. FINN.

GASTROPODA.

Appetite of Snails for Green Material.—With regard to your correspondent's interesting note on the appetite possessed by her Slugs for green material, it might interest her to know that I have observed the same characteristic in several specimens of *Helix aspersa* kept for observation purposes under the same conditions as those of your correspondent. I had for some time wondered over the appearance of small holes in the green covering; and I received the clue from your correspondent, and watched carefully. The Snails only attack the covering on nights when they have not had their usual amount of food—four cabbage-leaves (young and small). And they certainly do not make such quick work of it as did the Slugs. During the operation, the horny "jaw" seems to play a much greater part than does the actual radula; a fact I think rather curious, as the "jaw" seems actually to be *projected*, and the radula used simply to bring the muslin against it, not for scraping. They take a long time, as I watched one Snail at work for over half-an-hour before he severed a single mesh. I caught one Snail engaged in enlarging a hole already started, and, fearing it would escape, I acted on a foolish impulse and knocked it down; four Snails in succession came up to the hole, thrust their heads out, and seemed to look about them; then, apparently finding it impossible to get their shells out, with an air very humorous, inasmuch as it seemed to express disappointment, they retreated. Those parts of the muslin of which the colour has been altered by the deposit of mucus

are unattacked ; this is interesting, as the fact that they can detect coloration seems to indicate a higher sense of sight and less reliance on smell than some authorities allow. It would be very interesting to make similar experiments with other members of the Gastropoda ; for example, some of the aquatic Snails accustomed to feeding on Algæ, or even such salt-water species as the common Whelk.—R. CARDEW.

NOTICES OF NEW BOOKS.

A List of British Birds. Second and Revised Edition. British Ornithologists' Union. London : W. Wesley & Son. 1915. 7s. 6d.

THIS list is a revised edition of that compiled by a Committee of the British Ornithologists' Union in 1883, brought up to date and embodying the numerous additions to the British bird-list which have been made during the last generation ; this, of course, renders it indispensable for workers on our birds. A certain number of changes have been made in the scientific names, in conformity with the practice of American and German zoologists, in going back to the tenth edition of Linnæus. Personally, we do not see why British naturalists should follow the lead of either America or Germany (especially the latter !), since neither of these countries has published any work comparable with the British Museum 'Catalogue of Birds,' which is far more important to working naturalists than any edition of Linnæus ; the interest of the great Swede's work nowadays is after all historical, not zoological, just like that of Aristotle's. However, several well-known names, though technically inadmissible, have been retained in the present work to avoid confusion, and the references to Saunders's classical Manual and to the British Museum volumes are given as synonyms, so old-fashioned people are still well accommodated.

The derivations of the (more or less) classical scientific names are still given as in the first edition, and it seems to us that the work has here been ill-revised ; *Corone*, for instance,

only means "crow" in Greek, not Latin as well, as here stated. We fail, also, to see why Gesner's common-sense derivation of *arquata* in the Curlew's name from *arcus* (bow) should be set aside, as it corresponds so closely with the Greek *νεφελίνιος* (new moon) and the Icelandic "nefboginn" (bow-neb) applied to this bird. *Apropos* of changes in names, it must be admitted that it is a good idea to have given the reasons for these, as is here done, in the Appendix which terminates the book; in that which precedes this are given the species which are rejected as British, owing to the evidence being, in the Committee's opinion, insufficient. There are several errors here; it is not true, for instance, that the wild Canary is "imported in large numbers," and of the American birds cited few are ever imported at all; while as to Baer's Pochard, we happen to know that at the time of the occurrence in 1901 the few previously sent over were all safely interned at the Zoo.

Fauna of British India. Mollusca; Freshwater Gastropoda and Pelecypoda. By H. B. PRESTON, F.Z.S. London: Taylor & Francis. 1915.

THE present volume of the 'Fauna,' giving a complete systematic account of the freshwater Mollusca of our Eastern dominions, is a worthy companion to Mr. Gude's, recently reviewed in these pages, on the land Mollusca. The work is naturally only about half the size of the latter, the number of forms to be dealt with being so much smaller. The introduction contains some interesting bionomical notes, in compiling which the author has been, he says, indebted to Mr. B. B. Woodward's book 'The Life of the Mollusca'; but he has some interesting original observations, notably the record of *Limnaea* and *Pisidium* in Tibet at an altitude of 14,500 ft., apparently a record in molluscan life. The difficulty in drawing a line between brackish and freshwater Mollusca is also of interest bionomically, and Mr. Preston has solved it by generally including marine genera, whose members are liable to be forced into freshwater life by such conditions as occur in the Gangetic delta, where pools may become fresh by reason of excessive rainfall or by the silting-up of their saltwater channels.

The Minor Horrors of War. By Dr. A. E. SHIPLEY. London: Smith, Elder & Co. 1915. 1s. 6d. net.

THIS little book is a reprint of articles originally written in the 'British Medical Journal,' and contains an account of the various parasitic animals affecting the welfare of soldiers in wartime, such as body-vermin and the flour-moth, whose larvæ prey on biscuit; there are also chapters on Leeches, the supply of which has been greatly curtailed by the operations of belligerents over the areas whence these annelids used to be obtained. The book is adequately illustrated, and deserves, on the whole, the wide circulation it has even already had. Dr. Shipley says: "I confess that these articles have been written in a certain spirit of gaiety." We think the humour rather forced.

The Determination of Sex. By L. DONCASTER, Sc.D. Cambridge University Press. 1914. 7s. 6d. net.

THIS popular summary of one of the most fascinating problems in philosophical zoology is clearly written and well illustrated, and though from the size of the book it has been impossible to make it exhaustive, yet a bibliography of half-a-dozen pages is given for the benefit of readers who may wish to pursue the subject further, and there is likewise a useful glossary of technical terms. Dr. Doncaster's aim has been "to discuss all the more important lines of evidence which bear on the problem of sex-determination, and to illustrate each by one or more representative examples." The study of the determination of sex is, he points out, the study of the causes which lead to the production of an individual of one or the other sex. As these causes, when discovered, may not prove controllable by man, it is obvious that we cannot at present determine at our will the sexes of creatures yet to be born, or even predict them. He thinks, however, that the controlling of the sex of offspring, even in man, is not to be regarded as impossible of ultimate realization. Meanwhile, the present book teems with facts of interest, even to those whose acquaintance with the deeper aspects of such problems is limited, and many of the examples are illustrated, such as the extraordinary diversity of the sexes in the Sea-worm *Bonellia*, where the male is like a minute parasite;

the sex-limited *lacticolor* form of the Magpie Moth (*Abraxas grossulariata*), and the very rare gynandromorph variation in birds. The illustration here, a coloured one, forms the frontispiece, and represents a Bullfinch, male on one side and female on the other. The normal specimens contrasted with this, by the way, must be the large Northern Bullfinch, unless the specimen was a dwarf as well as sexually abnormal. With regard to the case of sex-linked characters most known to the world at large, the almost proverbially rare tortoiseshell tom-cat, it is of interest to note that such Cats appear to be generally sterile.

Reptiles and Batrachians. By E. G. BOULENGER, F.Z.S. London and Toronto : J. M. Dent & Sons. 16s. net.

MR. BOULENGER's position as the Curator of Lower Vertebrates in the Zoological Gardens has given him ample opportunities for observing the classes with which this handsome and fully-illustrated book has to deal, and what he has to say is put plainly and scientifically, without any of the striving after effect which is rather repellent in so many popular books. There are also a good many original observations, but on the whole there is not so much evidence of the author's professional opportunities as we could have wished, and the book cannot be compared, from a bionomical point of view, with some other standard volumes which have been published on the same groups. Some of the omissions in the work are really serious; thus, in the general account of the Batrachia, nothing is said about the absence of claws in all of them except the Newt *Onychodactylus* and the Anuran genera *Xenopus* and *Gampsosteonyx*, in the latter of which the claws are unique among vertebrates in being the bony ends of the phalanges themselves, not horny epidermal sheaths. The account of *Xenopus* does scant justice to this most interesting amphibian; the fact that the adult will eat dead food such as chopped meat is not mentioned, nor is anything said of a far more remarkable peculiarities of the Tadpole, the remarkable transparency which enables the brain and body-viscera to be plainly seen in the living animal. Yet this remarkable creature bred about twenty years ago in the Zoo collection.

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THE ZOOLOGIST

No. 888.—*June 15th, 1915.*

NOTES ON THE ORNITHOLOGY OF OXFORDSHIRE, 1914.

By O. V. APLIN.

January 1st.—Hard weather. A slow thaw set in.

2nd.—Starlings began to chatter. Hedge-Sparrow continues to sing.

3rd.—A Kingfisher killed by flying against the bridge in the middle of the village.

8th.—A very fine adult female Peregrine Falcon at the stuffer's, shot near Shenington about the 2nd inst.; of a very rich yellowish salmon-colour on the under parts. I heard later that a Peregrine was seen at Clattercote Reservoir a day or two before—perhaps the same bird.

9th.—Song-Thrush sang fairly well at 8 a.m. Mistle-Thrush well all day. Blackbird in rather a low tone in the middle of the day.

13th.—Many small birds round the ricks. Greenfinches very numerous now. Over thirty killed at one shot in a yard where poultry are fed.

15th.—News of a Hedge-Sparrow's nest with two eggs found in a field-barn at Salford on the 2nd inst. The bird was seen to visit the nest, but deserted it, owing probably to thrashing corn being carried on there.

19th.—Hedge-Sparrow sings occasionally (a Thrush on the 13th; cold day).

22nd.—Capt. J. V. Taylor, of North Aston (as he afterwards informed me by letter), saw over the flooded Bestmoor a

Sparrow-Hawk attacking a Common Buzzard. The hawk kept stooping at the Buzzard, which appeared to turn on its back and strike up at the hawk, uttering a loud squawk. Capt. Taylor, who had a strong pair of field glasses, and was often within thirty or forty yards of the birds, watched them for half-an-hour and saw the hawk stoop nine or ten times. Once the birds were so low that the Buzzard splashed into the water as the hawk stooped, but curiously enough the Ducks on the water took no notice, though they were right among them. Mr. Rose, of North Aston Mill, had also seen the two birds, and spoke of the size of the Buzzard, the first he had seen. Capt. Taylor said there had been two or three hundred Duck on Bestmoor (about seventy acres) daily for some weeks.

26th.—Thrush sang again. A Grey Wagtail in a running ditch at Wickham.

28th.—Mistle-Thrush sang well, early. A few Song-Thrushes singing; we have had a few of them here all the winter, but they have been silent a good deal.

29th.—Mr. E. Colegrave told me he saw a Great Grey Shrike at Bletchington about a fortnight ago. He got within six yards of it, and said it was a beautifully clear grey specimen.

30th.—Mistle-Thrushes sing beautifully now, from daylight on; but, as usual, not in the later afternoon.

31st.—Larks sang a little.

A cold frosty month (except the 9th and 10) until the 28th. Some snow, but weather not severe. Very dry. Rain on ten days; '68 inches only.

February 4th.—About 4 p.m. a flock of Geese flew over here, going E. N. E. From their curious cackling cry I think they might have been White-fronted Geese. They passed over the Grove estate, and were then estimated at four hundred. Blackbird sang again.

6th.—First rain this month.

14th.—Flock of about thirty Fieldfares on the wing.

16th.—Chaffinches singing well; an increase of old males lately.

25th.—Wood Pigeons cooed, the first noticed this winter.

26th.—Garden primroses at their best now. Rooks building, or playing at it.

27th.—A very clear evening. At 6.10 p.m. Song-Thrush, Tawny Owl, Partridge and Peewit (spring calls from hill), all to be heard at the same time; and Blackbird's song just before.

28th.—A male Blackcap in the garden, sang a little (*vide* 'Zoologist,' 1914, p. 237). Yellow Bunting singing. Fieldfares passing east at intervals, a few at a time.

About the end of this month Mr. Taylor saw a flock of Black-headed Gulls on his farm at Salford, and shot one. This farm, partly on the slope of the hills, is still a great resort of Peewits, and a score of eggs are sometimes found in a day when an arable field is being "worked" in the spring.

A mild month, colder towards the end. Rain on thirteen days; 2·27 inches.

March 6th.—Many Rooks' nests at Broughton. Some apricot blossom out.

7th.—The Blackcap singing for some time in the rain. It got out a good note once, and sang for five minutes at a stretch. Daffodils in flower.

8th.—Robin building (*vide* 'Zoologist,' 1914, p. 237).

9th.—Blackcap singing in the rain.

12th.—Floods coming out.

13th.—Goldfinch in my garden. The Blackcap singing rather well—some high notes.

15th.—Blackbirds very numerous, and the amount of song remarkable.

16th.—Song-Thrush's nest with one egg. The nest is small, badly made and placed, and the egg is small, as these early eggs usually are.

21st.—Snow on the last three days and frost.

23rd.—A pair of Goldfinches.

24th.—Greenfinch singing. Rooks cawing about nests until nearly 7 p.m. Hedges getting green in sheltered places.

25th.—A Marsh-Tit.

28th.—A Great Tit sitting in a hedge and singing from the same spot for some minutes. The song was "chaff, chaff, chaff, chiddy-wid" (or "chiddy-widdy") over and over again.

31st.—Blackthorn out. Great flock of Chaffinches, with some few Greenfinches, Yellow Buntings, Tree and House-Sparrows on a newly drilled field.

A Swallow at Kingham (Mr. W. W. Fowler).

A wet month. Rain on twenty-three days; 3·50 inches.

April 3rd.—Chiffchaff.

8th.—A clutch of four Crow's eggs, incubation just begun, brought in. Nest only slightly hidden in the upper fork of an elm. A second nest held one fresh egg. This is an early date for a full clutch. Pear blossom on wall.

10th.—A number of young Song-Thrushes and Blackbirds on the wing. Two Willow-Wrens (sang). Crown Imperial in bloom.

11th.—Two Swallows here, late in the afternoon. Young Mistle-Thrushes on wing.

12th.—For the second (mild) winter running the outdoor fuchsias have not been cut down to the ground, as they generally are here. A Small Garden White butterfly. House-Martin at Kingham (Mr. Fowler), early.

13th.—Redstart here. Tree-Pipit at Kingham (W. W. Fowler).

14th.—A good many Swallows about.

15th.—Small Tortoiseshell and Sulphur butterflies. Tree-Pipit (3) here. Redstart and Sandpiper at Kingham (W. W. Fowler).

16th.—During six or seven hours' Otter-hunting in the Evenlode Valley, above and below Charlbury, I only noticed, of migrants, many Tree-Pipits and Willow-Wrens, and one Chiffchaff. Cloudless sky.

18th.—Lesser Whitethroat at Kingham (W. W. Fowler), who writes to-day: "I have seen several cock Redstarts, and hope we are going to have them again at last." (But later they seem to have moved on.) "I have seen no Blackcap." He reports a Peregrine Falcon seen about there a few days before; also a Kittiwake picked up dead at Sarsden the day before.

19th.—My children saw a Squirrel in a fir belt near the village. I have not seen one in the parish for a very long time. A good many "Sulphurs" lately.

20th.—Cuckoo and Lesser Whitethroat.

21st.—Whitethroat. Orange Tip. A Nuthatch "twitting" on the Grove lawn.

22nd.—Green Woodpecker cutting out a hole in a poplar.

23rd.—Swallows, which have been away from the village,

perhaps on account of the dry weather, returned to-day. A slight shower.

25th.—Three Ray's Wagtails, near Adderbury, and one in the Cherwell Valley. Common Sandpiper. Found two old Otters and at least one cub in the Cherwell below Twyford Mill. Of the two old ones killed one looked quite 27 lb. and had old broken teeth.

27th.—Hawthorn in blossom.

29th.—Oaks coming out very early.

30th.—An increase of Swallows; the birds which breed in my buildings arrived, or some of them. Swifts arrived (six or eight) early. Blackcap (migrant) singing in front of the house. House-Martin (one) arrived here.

A warm and dry month. Rain on eleven days only amounted to .83 inches.

May 1st.—Oaks very early. Some have leaves two and a half to three inches, and oak galls as big as a "solitaire" marble. Gulls flying over, N., 8.30 p.m., moonlight. From their squeaky cries they seemed to be *Larus canus*.

2nd.—A very fine Whimbrel shot in a field near Deddington, where it had been seen all the previous day. A most destructive frost.

3rd.—There are four or five male Blackcaps near here, more than I have noticed for years. Redstarts too are more common, and I have seen eight or ten males.

5th.—One young Rook at least could fly well. A Goldfinch's nest in a horse-chestnut tree in the village. Garden Warbler.

6th.—Cuckoos very scarce, and I have heard the call hardly ten times this spring.

8th.—A Whinchat.

10th.—Swallows have mostly left the village, perhaps on account of the dry and cold weather. The oaks were earlier in leafing than I ever remember them before, and the ash is as remarkably late; no signs of growth on most of them yet.

13th.—Kestrel had five eggs in one of this year's Crow's nest, from which the eggs were taken.

14th.—Many Orange-Tips now and Holly Blues round a holly-tree here. Swifts screaming well for the first time.

15th.—Went to North Aston Mill to see some birds reported

as Curlews breeding on Bestmoor, a meadow of about seventy acres in the Cherwell Valley. As I expected, they proved to be Redshanks. The nest, with eggs, was found by the tenant at the end of April; but as he could not be found to-day we did not see it. It was described as "domed over" like a Magpie's. This, no doubt, meant that the grasses were brought together over the nest. We found the birds in the middle of the meadow, and they flew close to us uttering the "toor-e-loor" sometimes, but generally the "klip klip klip" of alarm, and we concluded they had young out in the grass. Mr. Rose, who took great interest in them, told me later that after the heavy rain of the 9th-11th June, bringing out a flood, he thinks the birds brought their young up the steep bank at the back of the moor and on to arable land. The old birds mobbed him there, coming very close and settling on a tree and a building. I believe the birds were seen the previous year; but no observations were made on them. This is a welcome, but not unexpected, extension of the breeding range of the Redshank in Oxon (*vide 'Zoologist,' 1913, p. 325*). We saw in a small steep bank in a field bordering the mill-tail a Kingfisher's nesting-hole. It was a place where earth or clay had been dug and was about five feet high. We could hear the young. The hole was about two feet deep and sloped upwards, allowing the filth to drain off. It was made and occupied last year. The birds always approach under a hawthorn bush at the edge of the mill-tail; and on leaving the hole always dive into the water. Mr. Rose thinks this is to wash themselves. We found a Reed-Bunting's nest with five eggs in a patch of flowering marsh marigold, with no other or higher cover, in the middle of the moor. A Sand-Martin was breeding in a drain-pipe let into a bridge carrying the road over the river; and a Wren had made a most conspicuous nest of brown dead leaves in the side of a haystack. The reeds here have made a heavy growth this year, the river banks having been uncleansed for some time, and we noticed a good many Reed-Warblers.

17th.—In a very long round in a car to-day into South Oxfordshire and parts of Bucks, we only heard the Cuckoo once. A fine bright day, and we stopped for lunch in the Chiltern Woods. Swifts were noisy, numerous, and low down in Chinnor village—a great place for them, I remember, more than thirty

years ago, and where they breed in holes under the eaves in the thatched cottages. A Corn-Crake reported heard to-day at North Aston Mill, the only one I heard of.

18th.—The scarcity of the Cuckoo is much remarked on. Blackcaps have sung little since the 12th, and have, I fear, passed on. Several pairs of Goldfinches about.

24th.—Flycatcher. Mr. Fowler wrote on this day of the scarcity of summer migrants, especially Whinchats, on the railway banks, where many pairs used to breed. He writes: "No Whinchats, no Yellow Wagtails, no Redstarts (or only one pair seen by A. H. M., which I can't find), and, still more amazing, no Flycatchers."

26th.—A most destructive wind-frost. A pair of Flycatchers in the garden for the first time.

27th.—Another frost.

30th.—Flycatcher's nest in half a cocoanut shell, torn down, by a cat probably, contained already three eggs. Peewit's nest with three fresh eggs. Another with four, slightly sat on, yesterday.

31st.—Redstart still sings. Turtle Dove.

The difference between the oak and the ash leafing is greater than I ever knew it before. Oaks came out in April, but the ash is hardly in full leaf, and some trees have shot very little yet. Some of them were cut by the last frost. A destructive drought now in progress. A dry month, with some hot days in the latter half. Rain (1.09 inches) spread over fourteen days, and therefore of little use.

The following is a short report on the numbers of the summer migrants noticed this year:—

Meadow-Pipit; very few passed. Chiffchaff; very scarce. Blackcap; several in April, more than for some years, but seemed to go on without breeding. Swallow; very few and some nests here not occupied. House-Martin; numerous; more than in the last year or two. A steady recovery. Willow-Wren; average of recent years. Cuckoo; scarce at first. Rather more later, but below the average of recent years. Tree-Pipit; average number. Whitethroat; average of recent years only. Lesser Whitethroat; scarce. Redstart; several pairs; more than for some years, but still far less common than

it used to be. Nightingale; none here. Garden Warbler; average. Turtle-Dove; scarce. Swift; below average. Whinchat; very scarce; only two pairs noticed. Ray's Wagtail; twice seen at migration time; none seen breeding. Flycatcher; very few. Shrike; none. Quail; none. Corncrake; none here. One at North Aston.

June 1st.—Visited Otmoor and found it unusually dry; the broad drains which last year were deep in water and impassable were now dry. Almost the only water in the "lakes" was in the big one called Fowls' Pill. The grass was late. We found several pairs of Redshanks, which mobbed us as if they had young. Several Snipe were "drumming," and others calling "wittuk" in the grass, and we flushed two birds. I again noticed Meadow-Pipits, two in song. There were a few pairs of Peewits on and around the moor; and a pair of Redstarts about the old willows by the Roman Way.

9th.—Mr. J. W. Palmer writes from Blenheim Palace to the 'Daily Mail,' as follows: "A steamboat with a weed-cutting apparatus is used on Blenheim lake to rid the lake of growing weeds. This boat is engaged at intervals, and has been so engaged for the last four weeks, sometimes steaming for as long as four or five hours at a stretch. A pair of Moor-fowl have built a nest in the stern of the boat, and the Moorhen has laid seven eggs therein, and up to the present moment has hatched out four birds; the remaining three eggs are chipped and the young will soon be afloat."

13th.—Heavy rain has fallen.

15th.—Went to North Aston Mill to visit the colony of Reed-Warblers, and found six nests, all where there was a good growth of reed (*Phragmites communis*). The birds do not breed in the beds of bullrush (*Scirpus lacustris*) or frequent them much. It was a brilliant early evening and I always noticed the birds near the nests and heard the song as we approached. The nests were all supported by reed stems (old and new) except in the case of the fifth, which was supported by two slight reeds and the stems of a *Thalictrum flavum*; a curious circumstance, as this is a very rare plant here. (i) Nest empty and I think flooded by the rise of the river about the 11th; (ii) Five eggs slightly sat on; (iii) Five eggs, hard set; (iv) Four young,

feathering; (v) Four fresh eggs; (vi) With big young, some of which left the nest when I parted the reeds.

18th.—Haymaking begun.

19th.—A Blackbird sang a short song at 8.55 p.m.; the Blackbird here does not sing late in the evening, so this was most exceptional.

25th.—Heard a Blackcap here again.

28th.—Mr. Fowler writes that “a Marsh-Warbler is now singing away charmingly in the original place of all, where you and I first heard it.”

Barred Woodpeckers about the garden lately and especially frequent on an old damascene tree. They often call in a low tone. This is a familiar bird on the whole. When I was sitting on the lawn one of them flew out of a low tree and passed close to me.

A dry month. Rain on nine days amounted to 2.68 inches. But as 1.86 inches of this fell in forty-eight hours, ending on the 10th, it saved the situation.

July 1st.—A destructive thunderstorm.

4th.—A white House Sparrow with pink eyes, which could just fly, caught in this village.

6th.—Some young Partridges could fly well, but one ran and hid itself in a tuft of grass. It was about as big as a Corn-Bunting, and the others looked so on the wing, less the tail, but the broad well-developed wings gave a broader appearance. Wing full feathered and body feathered, but the head and part of the neck still in down. I have seen only two Cinnabar moths this year.

13th.—A Holly Blue in garden.

26th.—Martins already congregate on house; this morning and earlier.

27th.—To see a young Cuckoo in a Pied Wagtail's nest built in jasmine, on the porch by the side of the front door at Wickham Mill. It was fledged, with tail about an inch long; and very fierce, striking with its wings, open-mouthed. It also pecked our fingers. Robin singing.

Rain (2.50 inches) on eighteen days.

August 2nd.—Goldfinch still singing in garden.

10th.—About a dozen Swifts, rather noisy.

11th.—Seven or eight Swifts.

12th.—Five or six.

14th.—Could see none.

15th.—Mr. T. A. Page told me that on the 14th at Enstone he saw a flock of large birds something like Herons flying in single file. The leader "marked time," the rest came up, and the flock then proceeded in a long line abreast. Their formation he said was quite regular. They flew about east, and there were twenty-seven of them. This description suggests Cranes very strongly.

18th.—We have had more Jays here than usual this summer.

21st.—When walking between the hedge and a crop of barley, or just inside the latter, I flushed a Land-Rail at my feet. I feel sure none bred in the parish this year.

22nd.—A lot of Martins on the roof. Between 9.30 and 10 p.m.—dark, cloudy, calm, with rain at intervals, a small flock of Whimbrel (from the cries, perhaps ten to twenty) passed over, going south. They were just in front of this house and I should think not much higher. I have often heard them pass over, but never before heard their cries so loud. Probably in the thick dark night the few village lights attracted them; but they went steadily on.

24th.—A Whiskered Bat caught in the house.

27th.—Willow-Wren singing.

30th.—Harvest chiefly finished, except some late barley.

31st.—A Grey Wagtail seen at Wickham Mill. A fine dry month after the first part. Rain (1.43 inches) on eleven days.

September 1st.—Blues, Small Heaths and Gatekeepers swarming, and a Painted Lady. Some Blues and Gatekeepers settling on wet mud round a spring.

Five Land-Rails reported seen near Milcomb.

4th.—Six guns and beaters walked nine and six acres of standing barley here without seeing one.

7th.—A number of House-Martins were swarming under the south eaves of my barn, and settling on the wall, before breakfast. They returned time after time when disturbed, but I could see nothing to attract them.

8th.—Many Red Admirals feeding on fallen plums, &c., lately; some Painted Ladies.

9th.—A few Wagtails on ploughing.

12th.—Many Martins on roof early in morning.

13th.—Five Red Admirals close together. Chiffchaff in song all the month.

19th.—Saw a silver-grey Hare (*vide* 'Zoologist,' 1915, p. 67).

20th.—A big gathering of Martins.

23rd.—A frost this morning. For the first time there were Meadow-Pipits in the root fields ; many of them.

24th.—Swallows and Martins gone, all but a very few.

27th.—A pair of Martins.

30th.—Here still and one or two other birds. A very good Partridge season ; the best for a good many years. Red-legged Partridges have made up their thinned ranks to some extent.

A fine dry, warm month. Rain (1.30 inches) fell on eight days.

October 2nd.—About a score of Martins and a few Swallows together ; passing birds, doubtless.

4th.—A few Martins here. A good many Jays about recently ; too early for migrants (*cf.* August 18th).

5th.—A few Martins here.

6th.—A Song-Thrush sang, the first this autumn. Larks singing (last heard, July 18th). Wren and Hedge-Sparrow sing.

11th.—Country dust-dry. Trees and hedges change fast.

12th.—Very few migratory Meadow-Pipits this year.

14th.—The first rain for weeks.

22nd.—Pied Wagtail singing.

Rain (1.62 inches) on eleven days.

November 1st.—Hedges thinned ; tree leaves all turned and many down.

7th.—A Common Buzzard seen at South Newington Hill to rise from a field where Pheasants and poultry had been reared. My informant, a Somerset man, knows this bird very well.

10th.—A Water-Rail in South Newington osiers. A few Meadow-Pipits in fields. Fieldfares have arrived and are scattered about in very small numbers. A Greenfinch sang.

14th.—A few Redwings.

15th.—Weather changed. Slight snow after frost.

18th.—A Nuthatch at the Grove, and some Bramblings heard. Larks have been silenced by the colder weather. A Corn-Bunting sang.

19th.—News from Mr. Heatley Noble of a Puffin caught alive recently in Oaken Grove, a few yards over our borders in Bucks.

23rd.—Very few Fieldfares here, and I can see no Redwings now.

24th.—Near Thrup I saw a flock of Peewits and Golden Plovers (separating at once) rise from some rushy fields. A Kestrel quietly hunting along a hedgerow at 4.15 p.m., seventeen minutes after sunset, and misty.

25th.—Milder weather again. Song-Thrushes singing again.

Mr. Fowler reported three or four Hooded Crows at Kingham about the end of this month, and a flock of Golden Plovers.

A rather wet month. About $2\frac{3}{4}$ inches of rain fell on nineteen days.

December 3rd.—An aconite just out. *Chimonanthus* in flower.

13th.—*Galanthus elwesi* out. Fieldfares and Redwings in quite small numbers this year, although the hedges are red with hips and haws.

19th.—A big flock of Fieldfares passed over, going south.

20th.—Colder weather.

21st.—Two or three inches of snow on ground.

23rd.—Very big floods about Oxford. Few Song-Thrushes wintering here.

24th.—More Redwings have arrived.

28th.—A very heavy fall of snow at night, fortunately melting to some extent.

29th.—Snowstorm was one of heaviest of recent years, and had not much of it melted as it fell, snow would have been very deep. As it is, it is six inches deep, and all shrubs much bowed down. A good deal of damage done. Fieldfares passing over at 4.30 p.m.; moonlight.

30th.—Snow melting fast.

31st.—Country very wet. Great floods in all the valleys. An Egyptian Goose, a straying bird of course, was shot about the end of the month at Great Rollright.

A very wet month; over 6 inches of rain besides snow, and it rained on twenty-three days.

NOTES ON STARFISHES FEEDING UPON *SIPHONOSTOMA TYPHLE*.

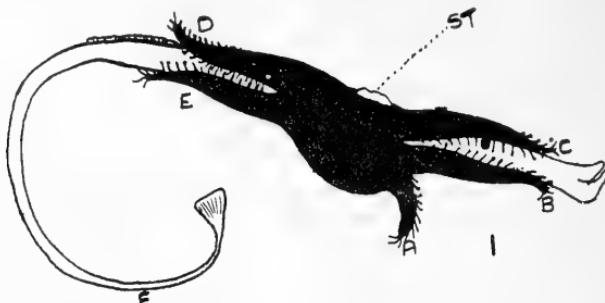
By H. N. MILLIGAN, F.Z.S.

In the April issue of 'The Zoologist' I published a paper describing the way in which two Common Starfishes made meals of two Pipe-fishes of the species known as *Nerophis aequoreus*. I have now to record the movements and behaviour of these two asteroids in feeding upon a Broad-nosed Pipe-fish (*Siphonostoma typhle*), which was considerably larger, and therefore more difficult to deal with, than either of the two Aequoreal Pipe-fishes.

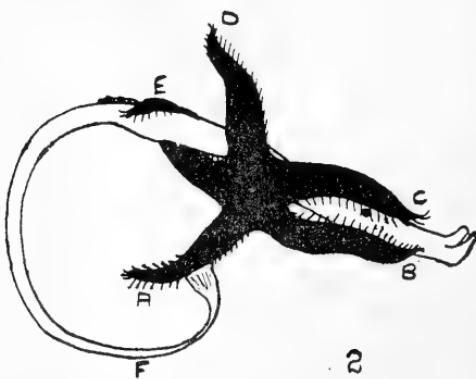
The Broad-nosed Pipe-fish, which measured twelve inches in length, five-sixteenths of an inch at its broadest, and three-eighths of an inch at its deepest part, although not in good health on the evening of April 8th, did not seem likely to die that night. On the following morning, however, I found that the Pipe-fish was dead, and that a Starfish was straddling over it. I do not know whether the fish had been grasped by the asteroid before or after death, but in the former case it seems probable that the Pipe-fish must have been in an exhausted condition when it was seized, because both this Pipe-fish and another individual of the same species, as well as two examples of the Pipe-fish known as *Nerophis ophidion*, had lived for several weeks in the same aquarium without being touched. I may here remark, however, that I have seen one of the Starfishes grasp with two of its arms an unhealthy and sluggish Fifteen-spined Stickleback, though without being able to retain it. I do not think the Starfish had been sitting over the Pipe-fish for more than about an hour before I found it, because, so far as I could see, only a little of the skin of the fish had yet been digested. The difficulties with which the Starfish had to contend in holding firmly the long body of the Pipe-fish were increased by the asteroid being on the side, not on the bottom, of the aquarium.

At 9.45 a.m. the Starfish, which I will call A, in order to distinguish it from the other Starfish in the aquarium, was in the posture shown in fig. 1, the bent tail of the fish resting on

the floor at F. The everted stomach (lettered ST) of the Starfish could be seen pressing upon the body of the Pipe-fish. The Starfish had placed its arms B and C parallel with, and on opposite sides of, the fish's head, and its arms D and E in the



same way along the fish's abdomen, apparently in order to prevent the long body moving from side to side and so disturbing the everted stomach of the asteroid. I had to record this method of holding the food firmly in my former paper. Some of the tube-feet of arms B and C, and of D and E, were attached by their disc-like ends directly to the body of the fish,

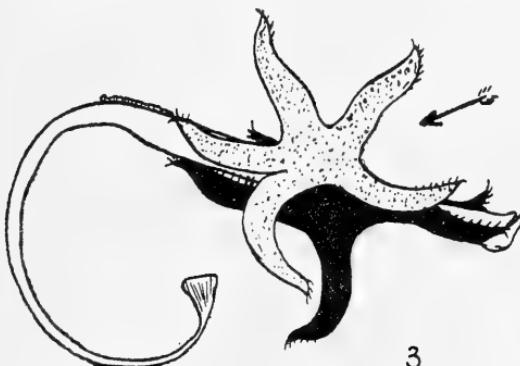


while others were merely laid across it without actually being attached to it. The Starfish hung upon the side of the aquarium by means of the tube-feet of arm A and some of those of the other arms, as shown in fig. 1. The disc of the Starfish was humped up in the usual feeding posture, and the papulae stood out conspicuously upon the upper parts of the disc and arms.

The Starfish apparently found the Pipe-fish too heavy a load to support for long in this awkward attitude, and it later shifted arms A and D to the positions shown in fig. 2, at the same time

curling the arm E tightly round the hinder part of the abdomen of the fish. Fig. 2 may be taken to represent the position of the Starfish between 10.15 and 11 a.m., but it was constantly making slight alterations in its attitude, and at no time was it quite still.

The other Starfish, which I will call B (*dotted* in the figures), had now begun to move towards the Pipe-fish. Starfish B had to travel about two feet in order to reach the Pipe-fish, and it moved so directly towards the latter as to leave little doubt that it had smelt the dead fish. At about 11.30 Starfish B reached, and began to press over and against, Starfish A (*black* in the figures) in the way shown in fig. 3, in which



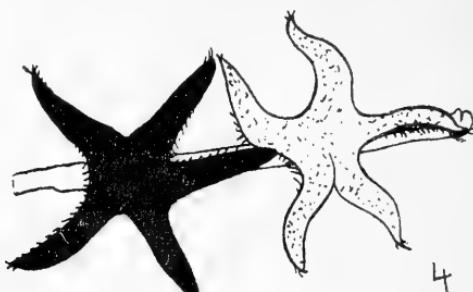
3.

the arrow indicates the direction in which B had moved towards the food. Starfish A seemed to be so much alarmed, or annoyed, by the persistent pushing of B, that within a minute or two of the arrival of the latter the former quitted the Pipe-fish and retreated to the floor of the aquarium.

Starfish A, however, only went about three inches away from the side of the aquarium, and then began to move to and fro, parallel with the body of the Pipe-fish, in a way which suggested that it was too much attracted by the smell of the fish to leave it, and by 12.15 p.m. it had wandered back again to the food. Both Starfishes must now have released their hold on the wall and retained a grasp only of the Pipe-fish, for the asteroids and the fish toppled over and fell to the bottom, where they assumed the positions shown in fig. 4.

Once more, though precisely at what time I do not know, Starfish A moved away from the Pipe-fish, and at 1.10 it was at

a distance of about three inches, moving irresolutely to and fro. It will be observed that again it was A which suffered itself to be driven off by B, although the former is slightly the larger of the two Starfishes. I thought on the first occasion that the retreat of A might be due to its being unable, with its everted and



therefore vulnerable stomach, to bear the thrusting action of B, the latter not having the disadvantage at that time of an everted stomach. The return and second retreat of A, when the conditions were reversed, seem to show that this apparent explanation is the wrong one, and I can only now suppose that B is a stronger and more vigorous animal than A.

I was not able to note the behaviour of the Starfishes at any time during the remainder of the day, but on the next morning I found Starfish B, perfectly still, at the opposite end of the aquarium, about two feet away from the Pipe-fish, while Starfish A was straddling over the latter, which it quitted at 10.15 a.m. I had now reluctantly to remove the decomposing body of the fish, which was beginning to make the water foul and cloudy, and consequently I could not make any further observations upon the behaviour of the Starfishes with the Pipe-fish.

I pointed out in my April report that those parts of the Pipe-fishes over which a Starfish had sat were digested and skeletonized. This Broad-nosed Pipe-fish had not been so well cleaned, partly no doubt because it was a bigger animal, but possibly also because the two Starfishes had each moved the Pipe-fish so much that neither had been able to press its stomach tightly enough upon the food. The fish had lost only a portion of the contents of its abdomen, together with patches of skin from the snout, head, and parts of the tail. Neither of the Starfishes had been fed for two days before that on which they began to eat the Pipe-fish.

NOTES ON THE COURTSHIP OF THE LAPWING.

By MAUD D. HAVILAND.

I.

DURING the early spring of 1912 and 1913 my attention was drawn to the courtship procedure of the Lapwing (*Vanellus vanellus*). My observations in these years were a good deal interrupted, chiefly owing to the lack of a suitable spot for observation; but in 1915, for a month from the middle of February onwards, I was able to spend some hours three or four times a week with the birds. Several pairs of Plover frequented this breeding ground, which consisted of two or three fields of fallow and stubble, separated by a deep grass lane, which was screened by high hedges. By making a *détour*, and approaching the spot by the lane, it was possible to hide in the hedge quite unseen by the birds, and I have frequently watched the actions to be described at a distance of sixty yards through $\times 8$ binoculars. Most of my observations were carried out early in the morning, partly for the sake of convenience and partly because at that hour there was less risk of disturbance by labourers working in the fields. The birds also showed the greatest activity just after sunrise, and, generally speaking, later on there was little doing.

Ten years ago Mr. Edmund Selous published an account of the courtship of this species,* but the conduct of the birds under my observation differed in several particulars from those that he described. Variations of climate, environment, and the physical condition of the individual bird make much difference to the form of courtship. Therefore, I venture to depart from the example set by Mr. Selous, and in the following account, which relates merely to my own experience, it is proposed to use the past rather than the present and more dogmatic tense.

* 'Bird Life Glimpses,' p. 163.

II.

For the purposes of this paper it is necessary to include in the term "courtship" all behaviour that is peculiar to the bird in the spring time, and not to confine it merely to those actions that are performed under the direct stimulus of the presence of the female. Thus considered, the courtship of the Lapwing comes under four heads, and these heads, for the sake of convenience, I propose to call by the names by which they are distinguished in my field notes :—

- a. The aerial tumbling.
- b. Stone picking.
- c 1. } Hustling.
- c 2. }
- d. The display.

(a) Can be dismissed in a few words, for, although the swooping and turning and the well-known call are characteristic of the spring season, they have nothing to do with the courtship proper.

(b) This also has only indirect bearing on the true courtship, but having regard to what will be related presently, it has been thought well to include it here. The cock bird stands sometimes for several minutes together picking up minute pebbles and flinging them over his shoulder. Occasionally, also, dry grass stems are gathered and thrown aside. The same action may be observed in the female bird when uneasy, for example, if she is kept for long away from her eggs, and *in itself* it is not indicative of more than a certain amount of restlessness and physical discomfort.

(c 1) This was much the commonest action, and is what Mr. Selous calls "rolling." However, I prefer this name of my own coining as being more descriptive of the nature of the action. The bird sank down and hustled the ground under his feathers in the same way as a nesting bird who prepares to cover her eggs. At such times the tail was held almost vertically, and the wings were partly opened. The bird's body moved up and down in rhythmical throbs. If the simile that occurred to me at the time may find place here, it resembled the pulsating movement of the abdomen of a wasp who cleans his legs and wings after a visit to the honeypot.

(c 2) This was a variation of the action described above. The preliminary movements were the same as in c 1, but when the bird was on the ground the wings were half opened, the head was curved under the breast, and the tail was spread fan-wise and sharply depressed. This attitude, which was nothing more nor less than a faithful representation of the sexual act, was generally both preceded and followed by c 1. It probably was the result of increased sexual excitement, for by reference to the accompanying chart it will be seen that it was indulged in more and more frequently as the pairing season advanced.

(d) This phase of the spring performance was the only one which took place under the direct observation of the female. I noticed it five times, and in each instance a hen bird, who was standing quietly some yards away, ran up to a male who was performing as in c 1, and pushing him aside, stepped on to the same spot upon which he had just been posturing and covered it herself. The cock bird with flattened crest and out-stretched neck ran stiffly away from her for a couple of feet. He then took up a position with his back turned to her, and the tail raised until it pointed upwards almost perpendicularly, and the tawny under coverts were fully displayed. He remained thus from thirty to fifty seconds, but each time the exhibition was rudely interrupted by another Lapwing, who swooped down upon the posturing bird, and the group broke up in the usual wild aerial romping.

All the preceding actions are noted by Mr. Selous. His description of d up to a certain point is identical with my own. He saw the hen bird enter the cock's "rolling ground" and cover it herself (*op. cit.* p. 164). He saw the little run and the pose with tail raised, and later on (p. 167) he speaks of the bright colour of the under tail coverts, "which I have seen apparently examined, even touched by one Peewit, when another, their owner, is rolling." But his conclusions differ from mine, for while he attaches no special importance to the latter incident, I believe, as I have described above, that the only part of the performance which is a deliberate display to a prospective mate is the exhibition of the anal parts.

On p. 165 Mr. Selous observes that the hen as well as the cock "rolled," and adds: "It is in a very imperfect, and, as

one may say, rudimentary manner, but I catch the characteristic though subdued motion with the tail." This is very interesting, for my experience has been that the indifference of the hens is one of the outstanding features of their spring behaviour. The only time that the female appeared to take any interest in the proceedings was when she ran forward as described in *d*, and sat down in the spot on which the mate had just displayed, but even then I never saw her assume any of the postures ascribed to the male. Presumably Mr. Selous relied only on behaviour in discriminating between the sexes, for he remarks elsewhere that "in field observation it is impossible to distinguish the one sex from the other." If his discrimination is correct (and Mr. Selous will pardon any implied doubt), his record is of much interest. It is, however, remarkable that the female should share in the actions described in the latter part of his note, which originally, if not now, must have been due merely to the male bird's physical condition.

It is needless to say that the actions that I have recorded did not take place with any regularity, and only to a certain extent with any sequence. *B* and *c* 1 occurred independently over and over again, although they were frequently combined; *c* 2 was nearly always preceded by *c* 1, and *d* was invariably preceded by *c* 1. In order to make the development of the courtship more clear, I append an analysis made from my field notes (see p. 221).

This analysis requires a word or two of explanation. The figures can only be approximate, and refer of course to the number of performances in each case, not to the number of birds seen. Up to five the actual number is given: six to twelve is marked "few," and over twelve as "many." I first observed the birds carefully on February 24th. Two males were posturing as *c* 1 in a stubble field. One four times picked up straws or dry rootlets, and tossed them aside. Afterwards I observed this gathering of straws on March 6th, 12th and 18th, though the birds were at all times accustomed to peck at pebbles, as noted under *B*.

On February 27th, and March 1st and 2nd, the columns are almost empty. The reason is that on these days I tried to carry out observations at daybreak, and found that at that time there

were no birds to be seen in the fields until an hour and a half after sunrise, when about twenty Plover flew over in a flock, presumably from some other feeding ground. They alighted on the plough, and stood about preening themselves and resting. As well as I could identify them through the glasses, all these birds were males.

APPROXIMATE NUMBER OF PERFORMANCES.

Date.	b.	c 1.	c 2.	d.	Remarks.
Feb. 23rd .	0	1	0	0	
„ 24th .	4	2	0	0	
„ 26th .	1	2	0	0	
„ 27th .	0	0	0	0	
March 1st .	0	0	0	0	
„ 2nd .	0	1	0	0	Ditto.
„ 4th .	2	many	0	0	Ditto.
„ 5th .	few	many	0	0	
„ 6th .	many	many	2	1	Females first appeared.
„ 7th .	—	many	few	2	
„ 9th .	many	many	few	0	Males plentiful.
„ 12th .	3	few	many	1	
„ 13th .	—	few	few	0	Birds feeding in pairs.
„ 14th .	2	few	many	0	
„ 16th .	4	few	many	0	Males outnumbered females 6 to 2.
„ 18th .	continuous	—	many	1	
„ 19th .	few	3	many	0	

On March 3rd I was unable to visit the place, but on the 4th when I, tired of the fruitless morning visit, went up in the forenoon, I found the birds very active, and counted among them four females, or about thirty per cent. of their number. From this date onwards both sexes were present each day, although the cocks always largely outnumbered the hens. On March 5th, 6th, 7th and 9th, the number of performances gradually increased. The male birds were very noisy and quarrelsome. On the 13th and 14th came a diminution in the numbers of actions seen, except in the case of *c 2*, which became more frequent. On the 18th I first noticed birds in pairs dotted about the field, but there was still a great surplus of cocks, and on the 16th I noted males outnumbered females in proportions of six to two. On March 19th my regular observa-

tions were interrupted by agricultural work in the fields, which disturbed the birds. The labourers quartered the fields constantly for eggs, and one of them told me that he found the first nest with an incomplete clutch on March 25th. I regret now that I did not find out whether the birds bred in the same field that was the scene of their amatory exercises, as this would afford considerable corroborative evidence for some of Mr. Selous's conclusions. I incline to think that a certain piece of ground is resorted to by the birds for their spring performance in the same way that Ruffs repair to their "fighting hills," for the reason that the ploughed field under my observation was constantly occupied by far more birds than could have all nested there, and these birds were all restless and quarrelsome. Meanwhile, on the neighbouring fields of grass and stubble, it was usual to see a number of Plover of both sexes preening and feeding quietly together without excitement. Besides, it is significant that I saw the courtship actions very seldom performed anywhere but on this ploughed field. There is also some little evidence that before the females appeared the male birds visited their playing grounds only at certain times. They seemed to arrive from one to two hours after sunrise, and I much regret now that I did not ascertain exactly when they left in the evening. They certainly were never at the place at dawn until March 6th, but after that date the white coverts of the posturing birds could be seen on the dusky fields long before it was light.

The behaviour of the cocks to one another showed a curious little analogy to that of the Ruffs. Although perpetually bickering there was never any serious fighting. Any quarrel ended in a harmless outburst of aerial swooping. Sometimes two birds charged each other on the ground with outspread wings, but when within striking distance each twirled round and stood with open wings with his back to his rival and bill drawn back, in which position he had a ridiculous appearance of futile pomposity.

In Howard Saunders's 'Manual of British Birds' it is stated: "The 'false nests' often found are scraped out by the cock in turning round when showing off to the female." This description is a little misleading. Judging from what I saw, the

"nests" in question would be made when the bird was "hustling" (*c 1* and *c 2*), and there was no evidence that this performance was gone through without any deliberate intention of charming the hen. Indeed, it was observed just as frequently when there was no female Peewit in the neighbourhood at all, and seemed to be simply an outlet for the male's excitement. I am not sure of the grounds of selection (if there was selection) in this species, but I think that there was a purposive display by the cock, and this display was not the "hustling" action at all, but consisted in the exhibition of the coloured under tail coverts.

From his observations on the courtship of the Peewit, Mr. Selous draws certain inferences as to the genesis of the nest-building instinct in birds. It is common knowledge that the handling of nesting material is a marked feature of the courtship of some species. It has been recorded of the Tufted Duck (Mr. S. E. Brock in 'British Birds'). I have observed it myself in the Reed-Bunting, and of non-British species it is only necessary to mention the Ostrich, the Adélie Penguin, and the Bower Birds. It would take too long to quote all of Mr. Selous's very interesting and ingenious exposition of his theory, but, if I have understood him rightly, he traces the original nest-building impulse back to similar purposeless movements, which were due to sexual excitement. "Its existence (the nest) would have been due to excited and non-purposive movements, springing out of the violence of the sexual emotions." I agree with Mr. Selous that the courtship actions of the *male* have most probably arisen thus, but what of the subsequent nest-building by the female? If the instinct of the hen to construct a nest has arisen from actions that are the outcome of her own physical excitement, why is it that we do not observe these actions more frequently during the mating season? It is not likely that the necessity for amatory exercises as a way of working off emotion should have lapsed in one sex and not in the other, especially when the ancillary, or ought we to say the resultant, passion to make a nest has persisted so strongly. According to the reasoning, we ought to find that certain female birds go through the same spring antics as the male. I know of none that do so, and Mr. Selous himself does not give any example, except that of the

Peewit alluded to previously. He does, indeed, remark: "In most birds probably—though this has been taken too much for granted—these frenzied movements, arising out of the violence of sexual desire, are more violent and frenzied in the male than in the female." But he goes on to say: "In this way we may see, upon my theory, the reason why the cock bird so often helps the hen in making the nest; nor is it more difficult to suppose that the hen in most cases may have been led to imitate him, than it is to suppose the converse of this." In the first place, it is at least very arguable whether the cock bird does often help the hen. From my own experience—which I quote with much diffidence, well knowing that it will not bear a moment's comparison with that of Mr. Selous—I should have said that the evidence went quite the other way. With regard to the latter part of the sentence, I admit that at first sight the complete spring procedure of the male Peewit looks extraordinarily like a rehearsal of what will take place by and by. There is the gathering of nesting material, and the formation of a nest, accompanied by significant postures. Here, on a superficial glance, we have something that looks curiously like a "suggestion" to the hen, that she may "imitate" in due course.

But when this "converse," that Mr. Selous rejects, is examined, the facts do not seem so plain. No one can have watched an incubating Plover or other ground breeder at close quarters without noticing the time spent by the bird in arranging the surrounding leaves, bents, &c., round the eggs, and it is well known that all nests undergo considerable repairs and structural alteration when circumstances require it. For instance, I have known a Dunlin, whose nesting hollow was flooded during the night, collect a rim of bents a quarter of an inch high round her breast. She did not grasp the necessity of raising the eggs themselves out of the wet, and consequently both she and they were still lying in water, but in her futile attempt to protect them and herself from the damp ground, do we not see the phylogeny of the nest ontogenetically reproduced? I find no difficulty whatever in believing that the origin of nest-building can be traced to the desire of the hen bird to shield her eggs from the mud. It is the very obvious remedy for a very obvious evil. But to imply, as Mr. Selous appears to do, that it

either arises or ever arose from imitation by the hen of the cock seems in the highest degree fantastic, and the idea is scarcely less improbable if we suppose that the cock's was the later impulse which arose consciously or unconsciously from experience of what the subsequent behaviour of the hen would be.

Until it is proved that it is the rule and not the exception for the female bird to display in the same fashion as the male, and for the male to share with the female the work of building the nest, I submit that there are no grounds to suppose, apt though the correspondence may be, that the two instincts (*i. e.* of the collection of nesting material in courtship by the cock, and of the making of the actual nest by the hen) have arisen otherwise than independently of each other.

[NOTE.—Since the foregoing notes were written I have learned that in the 'Zoologist' for 1911 Mr. S. E. Brock published an article on the courtship of the Peewit, and that the conclusions he drew as to the display are very similar to those I have put forward above.—M. D. H.]

NOTES AND QUERIES.

MAMMALIA.

Unusual Site of Rabbit's Nest.—On a farm in this parish a Rabbit has made her nest and brought forth her young just under the ridge at the top of a straw stack. The young have successfully made the descent to earth.—WALTER B. NICHOLS (Bradfield, Manningtree).

Variety of Water-Shrew (*Crossopus fodiens*).—A friend sent me a very nice variety of the Water-Shrew; it is almost white. It had black eyes, not pink, albino eyes. It was caught by a Cat and brought into the house. I have another similar specimen caught by the same Cat a short time ago; they were both caught from the same brook which runs near the house. This is the third specimen I have in my collection of almost white varieties of the Water-Shrew. The first-mentioned was obtained on July 23rd, 1914.—WILLIAM DAWS (Mansfield, Notts).

Pink Eyes in Dog.—Common as white Dogs are, I have never seen a pink-eyed white one till last month, when I noticed one evening that a pink-nosed white Pekinese in the possession of a passenger in a tube train seemed to have pink eyes. I have since got a good look at what I believe to be the same animal at close quarters in daylight, and find it has the pupils pink and the iris very pale blue; the person then in charge of it told me that the eyes look all pink at night, and that the Dog had had a mate with similar characters.—F. FINN.

Animal Fascination.—I once had an opportunity of seeing the terrorising power a beast of prey can have over its victim. In a pasturage beside a wood a number of wild Rabbits were feeding when the mask of a Fox appeared through the hedge. A large Rabbit, fairly near the intruder, gave the alarm by striking the ground with both hind feet twice, and then bolted for cover in the opposite direction, followed by all the others, save one small creature, who crouched in the grass, gazing at the Fox with dilated eyes. It uttered piercing squeals as the Fox approached, but did not attempt

to escape. The Fox silently took it by the nape of the neck, gave one quick shake, and glided away with the limp form hanging from his mouth. The victim was one of the smallest of the colony, being one of a litter born five weeks previously. The other Rabbits returned to their interrupted supper in a very few minutes after the departure of the raider.—(Miss) M. CALLARD (East Dulwich).

Whiskered Bat (*Vespertilio mystacinus*) in Lincolnshire.—On May 20th last I picked up in my garden here an injured specimen of the Whiskered Bat, and have sent it for preservation for the Lincoln Museum. This, I believe, is the first definite record of the occurrence of the species in this county. Mr. G. H. C. Haigh has failed to find the species in North Lincolnshire ('Zoologist,' 1887, p. 144), and there is no record for the county in the excellent article on this species by Mr. J. E. Harting ('Zoologist,' 1888, pp. 161–166). The late Major Barrett-Hamilton wrote to me on February 13th, 1913, that he had no actual record for Lincolnshire, though, taking into consideration its known distribution in East Anglia, it probably occurred in the county. I was not able to include the species definitely in my list of the Lincolnshire mammalia in the 'Transactions' of the Lincolnshire Naturalists' Union, 1912, and so it is satisfactory now to know that the species does occur in the county, at any rate in the district between Lincoln and the Notts border.—F. L. BLATHWAYT (Doddington Rectory, Lincoln).

Notes on the Cervidæ of Bedfordshire.—**IRISH ELK (*Cervus megaceros*).**—In the collection of Professor Joseph Prestwick, F.R.S., purchased by the Natural History Museum, South Kensington, in 1894, are a lower molar and the base of an antler which are labelled as of this species. They came from the Midland Railway cutting at Bedford, and were associated with remains of Hippopotamus and Red Deer. Mr. C. W. Andrews, who kindly gives me the above information, remarks that these specimens are very unsatisfactory material for a definite determination, but certainly agree most nearly with the above species.

RED DEER (*Cervus elaphus*).—In the famous gravel beds at Biddenham and Kempston, as well as in many other localities remains of Red Deer are frequently found along with palæolithic implements, the Mammoth, Hippopotamus, Ox, Horse, &c. Mr. J. Wyatt* wrote of great numbers of their antlers, some shed, and others with portion of skull attached, also teeth and bones, being

* 'Quarterly Journal Geological Society,' vol. xx. p. 186 (1864).

found at Summerhouse Hill, Cardington. Some massive antlers from that locality are in the Wyatt collection now in the possession of the Corporation of Bedford; the two largest being—No. 1, width of burr $4\frac{1}{4}$ in., circumference $12\frac{1}{2}$ in., width of beam above the burr 3 in.; No. 2, width of burr $3\frac{1}{2}$ in., circumference 11 in., width of beam above the burr $2\frac{7}{8}$ in. Mr. Worthington G. Smith presented me with numerous portions of antlers and other remains that he found during excavations in the waste pits at "Maiden Bower," and at the Blow's Down hut dwellings at Dunstable, which both date from the Bronze Age. None of these bear comparison with the largest of the Glacial Age; the heaviest measuring: width of burr 3 in., circumference $9\frac{1}{2}$ in., width of beam above the burr $2\frac{5}{8}$ in., above brow tine $1\frac{7}{8}$ in. Fragments of antlers have also been found in association with the Roman occupation in this county, and other finds have been made probably dating a much more recent period. To what century the Red Deer existed in a wild state in Bedfordshire I am unable to say. Woburn Park, the seat of the Duke of Bedford, is the only place in the county where this animal is preserved. Whitaker,* in 1892, gave the number of this Deer at sixty.

FALLOW DEER (*Cervus dama*).—The former existence of this Deer in a wild state in Bedfordshire rests on the finding of a brow tine portion of an antler, now in the writer's possession, that the late Major W. Cooper-Cooper obtained with Anglo-Saxon remains dug up in a gravel-pit near Fancut, Toddington, and there is little doubt that this portion of antler dates also from that period. At Woburn Park Whitaker† gives the number of this Deer in 1892 as three hundred and eighty, and in Wrest Park, Silsoe, two hundred. On the latter estate at the present time they number about two hundred to two hundred and twenty, but these will cease to exist before the end of the year.

REINDEER (*Rangifer tarandus*).—Fossil remains of the Reindeer seem to occur not uncommonly in the Pleistocene gravels of the Ouse Valley in this county. In the Wyatt collection are several portions of antlers of this animal; they are labelled "Howard's Field, Bedford," another "Bletsoe," and a third "Kempston Road. Mr. J. Wyatt"‡; also found Reindeer at Summerhouse Hill, Cardington. Harting,§ quoting probably from the same authority, writes of the

* 'The Deer Parks and Paddocks of England,' J. Whitaker. 1892.

† *Loc. cit.*

‡ 'Quarterly Journal Geological Society,' vol. xx. p. 186 (1864).

§ 'Extinct British Animals,' J. E. Harting. 1880.

remains of Reindeer being found at Bedford, associated with flint implements, Red Deer, and Hippopotamus. In the collection of Mr. Worthington G. Smith there are at least parts of five antlers, all from Kempston, and several in my own possession from the same locality.

ROEBUCK (*Capreolus caprea*).—It is owing to the indefatigable researches of Mr. Worthington G. Smith, F.L.S., that I am enabled to include the Roebuck as evidently at one time plentiful in the county. Amongst the refuse accumulations of the Bronze Age dwellings discovered by him at "Maiden Bower," and on the hut floor bottoms some 3 ft. to 4 ft. deep at Blow's Down, Dunstable, were found remains of this Deer. Two almost perfect and fully developed antlers, one from each locality, being presented by him to me. Further remains of this species were also found by the same authority in the chalk cutting north of Dunstable. These latter being in association with Roman remains, it brings forward the occurrence of this Deer in the county to a still more recent period.—
J. STEELE ELLIOTT.

A V E S.

Observations on Bird Life in Aberdeenshire.—Some peculiar conditions prevailing brought forward here a closer association in various birds with winter and spring than I ever saw before. Migrants in ordinary seemed to leave comparatively early, considering the weather. The Sky-Lark made a continuous effort at singing through the winter; on January 15th I satisfied myself that it was the abundance of worms available for food which made this bird sing. Another phenomenon was the continuance of a male Pied Wagtail all winter. Whether he had been here in summer or landed in the fall I know not. He was a good specimen, and might have chosen to stay on through superior physique or otherwise, or may have landed from some summer resort further north or so. He appeared at times near houses on turnip fields. He seemed alone at the plough on March 11th; by March 16th there were plenty along this route; he was rather shy. The Lapwing was heard on December 29th. None just here until February 16th, so far as I knew. A Redshank appeared on November 4th and 5th; might have stayed, but Lapwings fought it. Appeared very tame on March 9th, evidently before storm. Golden Plover whistling in Alford, N.B., on November 17th. At work here on February 16th. The Curlew last noticed on September 22nd; flock at Breda, Alford, on March 9th. Here, six miles further inland, on 11th. Flocks here later, and continue this

way during stormy weather. The last call of the Oystercatcher on September 1st; appeared at Breda on March 9th, besides Curlews; here on the 10th with Redshanks at the plough. There were three species of Gulls frequenting this part—very tame at plough from March 7th—I believe Brown-headed Mew, Green-billed Gull (*Larus canus*) ; the other was smallest and strange to me. Would it be the Little Mew or Gull (*Larus minutus*)?* A large gathering of Water-hens appeared here in the fall, feeding even among poultry on the fields; they moved away later. Flock of wild Geese heard and seen going south on October 16th ; heard passing north, evening, March 18th. An interesting case of a Bullfinch appearing here on December 23rd during the very severe frost ; they make periodic visits at any season of the year here.—WILLIAM WILSON (Aberdeen, N.B.).

Hawks Selecting White Young Pheasants : Young Pheasants flying without apparent cause.—During my experience as a game-keeper I used to notice that if we had a white chick among the young Pheasants, a Hawk was sure to take it; is this a usual experience? Secondly, why do young Pheasants, when about a month old, often suddenly get up in a body and fly round like Pigeons, to settle again near where they started? They make only one sweep, and low down; I could never find a Stoat or any such enemy to account for it; so perhaps they only do it for exercise.—WM. ELCOME (Regent's Park).

Some Migratory Incidents in May.—The Swift, Swallow, House and Sand-Martins all appeared about the same time, that is, from May 3rd to 6th. I noted two Tree-creepers here on 10th, probably nesting in a small clump of trees; the last I noted was in mid-winter some seasons ago. I had a flock of Fieldfares on my grass on 13th, the result of the wintry cold, snow being on high ground. I do not recollect this before at the date when nesting would have been in progress. There might have been some Mistle-Thrushes too. I noted Warblers at various points over several miles on 18th, but they seemed mute and shy, the result of the cold. I observed on the wayside a White Wagtail on 18th near Mossal, the first I have ever seen. A feature worthy of notice is that up to date of writing—May 31st—I have seen no Wheatear (*Saxicola oenanthe*) nor Whinchat nor Stonechat. Quoting from 1906, I have the first, April 8th (Zool. p. 196) ; second, May 19th ; with no appearance of the third

* Not at all probable, this bird being a rare visitant, and *very* small, only size of tame Collared Dove.—(Ed.)

which was then fading in area. I noted all three here in 1914.—
WILLIAM WILSON (Aberdeen, N.B.).

Moorhen Nesting in Disused Nests of the Magpie.—Frequently the Moorhen selects a nesting-site several feet above the water, finding suitable accommodation on the tops of stumps, ivy-covered trees, in overhanging bushes and such-like. In one instance that came under my notice at Muggerhanger a pair had utilized as a foundation for their nest a Ring-Dove's platform built in a hawthorn tree overhanging a pond, some twelve feet above the water. But what is unique in my experience is a pair using nests of the Magpie. I was informed that three eggs had been taken from a nest on a hawthorn tree on May 1st last, alongside Duloe Brook at Basmead, Bedfordshire, and, wishing to satisfy myself on various particulars, I visited that locality. The tree was some little distance from the stream, and the nest thirteen feet above the ground, and scantily lined with just a few blades of rush. Visiting another Magpie's nest on May 15th, along the same brook and at some short distance away, I found what was evidently the same bird sitting on four eggs, three others being smashed on the ground beneath. This nest was built in some very tall blackthorns, and seventeen feet above the ground, and in this instance a better lining had been added, but by no means the complete inner lining to a normal Moorhen's nest.—J. STEELE ELLIOTT.

Malformed Beak of the Jackdaw.—A friend sent me a Jackdaw with a curious malformed beak. It is a perfect copy of the beak of the Common Crossbill. It is a wonder how the bird managed to obtain its food, yet it was in good condition. A man shot it along with three Rooks. The shooter said he was going to make scarecrows of them to keep the Rooks from his potatoes, but my friend noticed its curious beak, and asked him for it. I have now mounted it for my collection. It was killed the last week in April, 1915, but I do not know the exact date.*—WILLIAM DAWS (Mansfield, Notts).

The Food of the Tawny Owl.—Two broods of Tawny Owls have been under my observation during the last few weeks, and when a keen young naturalist from one of our public schools paid me a visit during the Easter holidays, I had the pleasure of showing him both

* In a garden at a schoolfellow's house at Maidstone we were shown in our boyhood a Jackdaw allowed to go about free with a clipped wing, and find its own food, but nevertheless the upper bill was overgrown and curved down, so that the beak looked like an eagle's exaggerated.—(ED.)

families, with three young in each. One pair of Owls nested in a box near this house, the other in a place in the church tower which they have now used with more or less success for nine years following. In the box we have only found remains of the Mistle-Thrush and Starling, but in the tower Rats (six), Field-Mice (three), House-Mouse (one), Thrush, Blackbird, Robin, Hedge-Sparrow, Swallow, Sparrow, Chaffinch, and Greenfinch. One evening two schoolgirls came to the church to see the Owlets, both being interested in Nature-study, and we found that an unlucky Kestrel had got into the tower. As the upper part is wired in, the question was how to get him out, and the poor bird's efforts to escape were pitiful. We could not bear the idea of his dying of slow starvation, and one of the girls made a plucky effort to catch him by scrambling over an ancient and by no means secure bell-frame, but just failed. Next day I went up and found the Kestrel still there, and in the Owl's nest the remains of a Thrush and a young Rat. These I felt justified in using as food for the Hawk, so I put them in a conspicuous place on a cross-beam, and the next day every trace was gone, also the Kestrel. Probably from his feeding-place he either saw or heard the Owlets, came down to them, and made his escape by the loop-hole. Another day one of the old Owls was in the tower, but seemed quite at home. Perhaps few Owls' nests have had more numerous and more appreciative visitors than ours, and there is every reason to hope and believe that a generation of young Nature-lovers is growing up among us, far more observant and less destructive than some of us were thirty or forty years ago, for whom the field-glass and the camera have taken the place of the gun and the collecting-box.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds).

Successful Courtship of Javan Peafowl.—It is such a common observation that hen birds seem unimpressed by the display of their males, that what I observed at the Zoo this spring with the Javan or Burmese Peafowl (*Pavo muticus*) seems worth recording. The male was in full display when the hen came up and looked at him; he rustled his train and uttered a peculiar long shrill cry, quite different from his ordinary note (which is like the call of the common Peacock, but much subdued); this seemed to show excitement, but the hen walked round behind him and seemed unimpressed. However, she came round in front again, was again greeted with a rustle of the train, and then crouched on the ground. The cock again uttered the peculiar shrill cry, and pairing immediately followed, after which he displayed for some time, while the hen wandered off and

ultimately lay down. Now the pairing of Peafowl is very rarely observed ; I have only once seen it even with the common or Indian species (*P. cristatus*). In this case, also, the cock was displaying, and uttered a peculiar call (but not exactly like the Javan bird's) before the act, but there was no obvious attention to the display or invitation on the part of the female.—F. FINN.

Use of Muscovy Ducks and Guinea-fowls.—In times like the present, when expenses are being cut down everywhere, there is a danger that the above birds may be killed down as not worth their corn. I should, therefore, like to put in a plea for the Muscovy Duck as the most easily bred and reared of all poultry ; the females are as motherly as any hen, and the birds will thrive away from water better than common Ducks. I recently bought, and tried the flesh of, a bird of this species—a male of about 9 lb. weight—bred two years ago at the Zoo from an imported wild male ; though not of quite so fine a flavour as a good common Duck, it was not tough, as I have found adult Muscovys which I have had to eat on board ship, and had no objectionable taste, nor was it grossly fat, though it had passed its life in an enclosure about six yards square. With regard to the Guinea-fowl, its table excellence is well known, but it is not much kept ; what I should like to draw attention to is its extreme watchfulness, which might render it a useful sentinel against air attacks. Last summer an aeroplane-shaped kite was flown over the Zoo, and of all the birds a common Guinea-fowl (of the wild race) was the most loudly and persistently clamorous. Of course, such birds would only be useful where air-craft are but rarely seen.—F. FINN.

A Correction.—“Ornithological Report for Norfolk.”—On p. 123 of this “Report” the names Zwanenwater and Naardermeer have been accidentally transposed. Mr. Jac. P. Thijssse, of Binnenduin, is pretty sure that the Spoonbills which come to Breydon Broad are non-breeding birds from these two Dutch resorts, the more so because in July and August Spoonbills are to be seen in Holland flying about the country miles beyond their breeding-places. As Secretary to the Dutch Bird Protection Society, Mr. Thijssse naturally takes great interest in the welfare of these Spoonbills, and it was with his assistance that the excellent map of their breeding-places by Mr. C. Candler was prepared for the Norwich Naturalists’ ‘Transactions’ (vol. v. p. 166). On p. 138, line 34, Tawny Owls should read Barn-Owls. Page 126: Dr. C. B. Ticehurst questions the Rooks and Hooded Crows which have been seen arriving at Yarmouth in

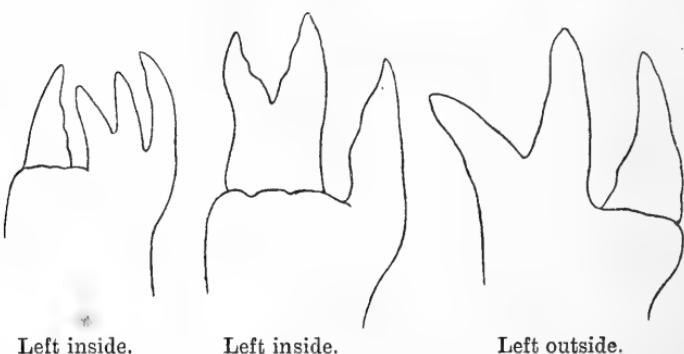
February being really oversea migrants. He sees this movement on the coast (at Lowestoft) every year, and is of opinion that they are only birds which have essayed the easterly passage, and after putting out to sea have turned back again, either because of haze at sea, or because the wind was too strong for them. Page 140, line 7, add: An adult Wood-Sandpiper in summer plumage was received by Mr. H. Pashley on September 1st.—J. H. GURNEY (Keswick Hall, Norwich).

C R U S T A C E A.

Notes on the Edible Crab (*Cancer pagurus*).—I was much interested in looking over some back numbers of the 'Zoologist' to read some remarks by Mr. Arthur H. Patterson on the size and weight of the Edible Crab ('Zoologist,' 1913, p. 77). In the Baily Museum at Mansfield there is a specimen from Mount's Bay, Cornwall—in fact, it was taken at Mousehole—which weighed 9 lb. 6 oz.; the girth of the hand is 9½ in. I have one in my own collection from

ABNORMAL HANDS OF CRABS.

Double chela.



the same place that weighed 10 lb. 7 oz.; length of carapace 7½ in., breadth of carapace 10½ in., length of front leg to point 17½ in., girth of wrist 9½ in., length of chela 5¾ in. Some years ago I sent home from Mousehole a living Edible Crab to be used for the table that weighed 11½ lb., but no portion of it was kept; of course it had to be broken up to obtain the contents for the table. I send you a rough sketch of three claws that I have recently obtained for my collection (I have the Crabs entire); you will see by the sketch that one has a *double* movable chela.—WILLIAM DAWS (Mansfield, Notts).

NOTICES OF NEW BOOKS.

Life-histories of African Game Animals. By THEODORE ROOSEVELT and EDMUND HELLER. In two volumes. London: John Murray. 1915. £2 2s. net.

THIS is by far the most important book on the subject of bionomics generally, and the large African mammals in particular, that has appeared of late. It is well illustrated by photographs of animals living and dead, by the beautiful drawings of Mr. Philip R. Goodwin, and by many maps; and the treatment of the subject is admirably clear and very readable, without any of the odious journalistic touch which has crept so much into zoology of late years. Although of the two authors each has "reviewed, added to, and assented to the work of the other, and their responsibility for the entire book is joint," the first drafts of the life-history accounts of the species and the introductory chapters on "Game Reserves" and on "Concealing Coloration" were written by Colonel Roosevelt; the other introductory chapters on the "Derivation of the Fauna, Geologically and Palaeontologically" and on the "Flora of East and Middle Africa and its Relation to the Fauna," and the technical descriptions, including the nomenclature used, are especially the work of Mr. Heller. It is here that working naturalists may find some points that are not to their taste, such as the separation of the Lion (an animal better and more anciently distinguished as a species than any other) into subspecies (though in the life-history portion it is stated that development and colour of mane are individual), and the generic separation of the White-tailed and Brindled Gnus. These, however, are of comparatively little importance and do not affect the great value of the major portion of the book in which the predominant influence of the ex-President is apparent. Here the work goes far beyond the subject of African game, and launches into discussions on more general topics, handled in a masterly manner

which should ensure the book a welcome in every library, where it may be of use to students of evolution as well as to the much smaller class to whom it would seem especially to appeal. Colonel Roosevelt, for instance, although quite able to see the utility of protective coloration in certain cases, is strongly opposed to the school which see it everywhere and give it exclusive survival value, and his treatment of the subject may be well exemplified in the following passages, dealing not with African animals but with forms more familiar in our own fauna.

After quoting the theory that the white-spotted coats of the Fallow and Axis Deer are protective in their environment of sun-flecked woodland, and that such spotted patterns evolve into self-colours when they "fail to serve any useful end," he says:—"If only the Fallow Deer and Axis were considered, it would seem convincing. But it breaks down completely when other Deer, the majority of Deer, are considered; for although they still live in the cover afforded by vegetation, and are descended from spotted forms, the adults, in the large majority of the species, have lost their spots. Take the abundant and widely-spread white-tailed Deer of America, which, in its various forms, extends from the northern isotherm marking the northern range of the Fallow Deer to the tropics, between the isotherms in which the Axis dwells. The fawns are spotted; doubtless the adult ancestral Whitetails were spotted; the Whitetails live now in just such cover as do the Fallow Deer and Axis; and yet they have lost their spots and are solid-coloured above. It seems incredible that natural selection can be responsible for both of two such diametrically opposite results; and, of course, if being spotted tends to conceal the Deer, then the loss of the spots cannot have been due to natural selection making for a concealing coloration. This is self-evident. The Red Deer, which lives in the same country as the Fallow Deer, and the Sambur, which lives in the same country as the Axis, have also both lost their spots in the adult forms. All these Deer have substantially the same foes; Wolves or Wild Dogs and the big Cats. If a spotted coat really is concealing, then surely natural selection ought not to have eliminated it in the great majority of the Deer, as it has actually done."

The above passage well illustrates the philosophical manner

in which the authors treat the current ideas widely accepted by naturalists of less experience; equal philosophy and wealth of wide observation is shown in the following, in which they discuss the gait of heavy ungulate mammals: "It (the Eland) has one characteristic seemingly inconsistent with its great size and lack of speed, and that is its extraordinary power of leaping. When startled, and beginning a run, the huge cows, and even the bulls, bound like Gazelles, leaping clear over one another's backs. It is extraordinary to see such bulky, heavy-bodied creatures spring with such Goat-like agility. It would seem that the mechanical reasons which make the trot their natural gait, and make their gallop slower and more tiring than the gallop of the Oryx or Hartebeest, would also limit their jumping powers; but this is not the case. They are heavier-bodied than Moose or Wapiti, with huge necks and barrels, and pendent dewlaps and wrinkled neck skin, yet, for a few seconds after starting, they make high jumps of a type which Wapiti rarely, and Moose never, attempt. The Wapiti, however, although their normal gait is also the trot, and although heavy Wapiti bulls are speedily exhausted by a hard gallop, at least sometimes run faster than running Black-tailed Deer—we have seen this ourselves—whereas the Eland is at once left behind by frightened Oryx or Hartebeest—as we have, also, ourselves seen. The Moose is even more of a trotter than either Eland or Wapiti. Young Moose will occasionally gallop, not only when frightened but even when at play; but the old animals practically never break their trot, except that, as we have been informed by entirely trustworthy hunters, when suddenly and greatly startled they may plunge forward for a few rods in a kind of rolling run. We ourselves once saw the tracks where a big (though perhaps not quite full-grown) Moose had thus plunged for a few jumps at a gallop. These very big and heavy species of Antelope and Deer evidently find the trot, and not the gallop, their natural speed gait, whereas the smaller Deer and Antelope find the gallop equally natural—although the Gerenuk trots fast and the Rocky Mountain Blacktail proceeds by buck-jumps. The big Zebra trots much more freely than the small Zebra. From these examples it would seem natural to lay down the rule that increase in size and bulk tends to make the trot mechanically preferable to the

canter and gallop. But this does not apply to cattle; Bison and Buffalo, unlike Eland and Moose, always gallop when at speed; and the Giraffe, which is bigger and heavier than any of the pure trotters, never trots at all, passing immediately from a walk to a canter or gallop. It all illustrates anew how limited our knowledge really is, and how cautious we must be in dogmatizing, or in glibly advancing explanation theories of universal applicability.' This is quite in the vein of Darwn's cautious treatment of his own suggestions; in fact, taking this book and other of Colonel Roosevelt's works with which we are acquainted, we are inclined to think that in a politician and man of affairs we actually have the "second Darwin" some zoologists are waiting for.

The Amateur Menagerie Club Year-Book, 1914. Edited by
G. TYRWHITT-DRAKE.

THIS neat little volume, illustrated by quite a number of photographs, is the third year-book which has been issued by the Amateur Menagerie Club, which now numbers sixty-eight ordinary and four honorary members. The papers contributed vary much in subject and merit, and some really useful observations are recorded. Notable among these is Mrs. Rose Butler's note on the liking exhibited for plums, gathered by itself from the garden wall, on the part of her tame Striped Hyæna, and the fact that in its disposition the beast is rather Cat-like than Dog-like (confirming the evidence of its anatomy), and that it is in good health and shows no signs of age at thirteen years old. Mr. Tyrwhitt-Drake himself contributes also some good notes on Lions; he finds that these animals recognize their human friends by the voice * rather than by sight, and mentions a troupe of four performing animals which he knows to be twenty-one years old, but finds still "healthy and presentable, though very slow." Dr. Graham Renshaw, in an article on "Rare Beasts in Continental Zoos," records a white Himalayan Bear

* *Apropos* of this, we may mention that in taking parties round the Zoo, we have never been able to complete our peripatetic lecture in the Lion-house; the Lions always try to roar us down, disliking our voice, no doubt!

seen by him at Amsterdam in 1900; there was one recently at our Zoo with white fore-paws and the breast patch much extended downwards, by the way. He says the fur had "a yellowish tinge quite distinct from the pure snowy whiteness of a Polar Bear"; but, as a matter of fact, Polar Bears, at any rate when adult, are generally creamy or straw-tinted, though whiter as cubs. Students of inheritance will find interest in Professor Cossar Ewart's papers on "Experiments with a Mexican Dog (of the Chihuahua breed)" and with Prejvalsky's Horse. In a future edition, by the way, more attempt should be made to ensure correct spelling of names.

Report on Cetacea Stranded on the British Coasts during 1914.

By Dr. S. F. HARMER, F.R.S. British Museum, 1915.
1s. 6d.

THIS Report on the specimens of Cetacea stranded on our coasts during 1914 has been carried through by the aid of information communicated owing to arrangements made by the Board of Trade, and these have been more thoroughly carried out than in 1913, at least until the outbreak of war naturally occupied coastguards otherwise. In spite of this, however, fifty-seven records go to the share of 1914, as against seventy-six in the previous year, and the evidence obtained for 1914 is more precise, efforts having been made to obtain the lower jaw of small species and a plate of whalebone in the case of Whales possessing this, such samples being generally sufficient for the identification of species. The Report, which is illustrated with a text-figure and three maps, deals with the following species: Common Porpoise (*Phocæna phocæna*), Common Dolphin (*Delphinus delphis*), White-beaked Dolphin (*Lagenorhynchus albirostris*), Bottle-nosed Dolphin (*Tursiops truncatus*), Pilot Whale (*Globicephala melæna*), Bottle-nosed Whale (*Hyperoodon rostratus*), Sowerby's Whale (*Mesophodon bidens*), Common Rorqual (*Balaenoptera physalus*), and Rudolphi's Rorqual (*B. borealis*). As one would expect, the records are far the most numerous in the case of the first-named, and on fifteen more or less complete specimens of the lower jaw an interesting study of the teeth and rate of growth has been based by Dr. Harmer.

A List of the Birds of Malta. By GIUSEPPE DESPOTT.

MR. DESPOTT, who is Curator of the University Museum of Natural History at Malta, has compiled a useful list, with local as well as English and scientific names, of the birds observed at Malta up to the end of last year. Most of these are visitants on migration only, and many of them uncommon at that, the chief regular breeders being the Blue Rock Thrush (*Monticola cyanus*), Spectacled Warbler (*Sylvia conspicillata*), Spanish Sparrow (*Passer hispaniolensis*), Corn-Bunting (*Emberiza milo*), Short-toed Lark (*Calandrella brachydactyla*), Kestrel (*Falco tinnunculus*), Southern Herring-Gull (*Larus cachinnans*), and Storm Petrel (*Procellaria pelagica*). There seems to be a regrettable diminution in many species.

Some occurrences are very remarkable, such as that of the Indian Brahminy Kite (*Haliatur indus*), though this harbour-haunting bird might easily accompany a ship; and that of the Algerian Bush-Babbler (*Argya fulva*), which we consider more curious than that of *Porphyrio cœruleus*, which Mr. Despott excludes. True, the species is local, but it can swim, and the *Rallidæ* generally are notorious for turning up in out-of-the-way places.

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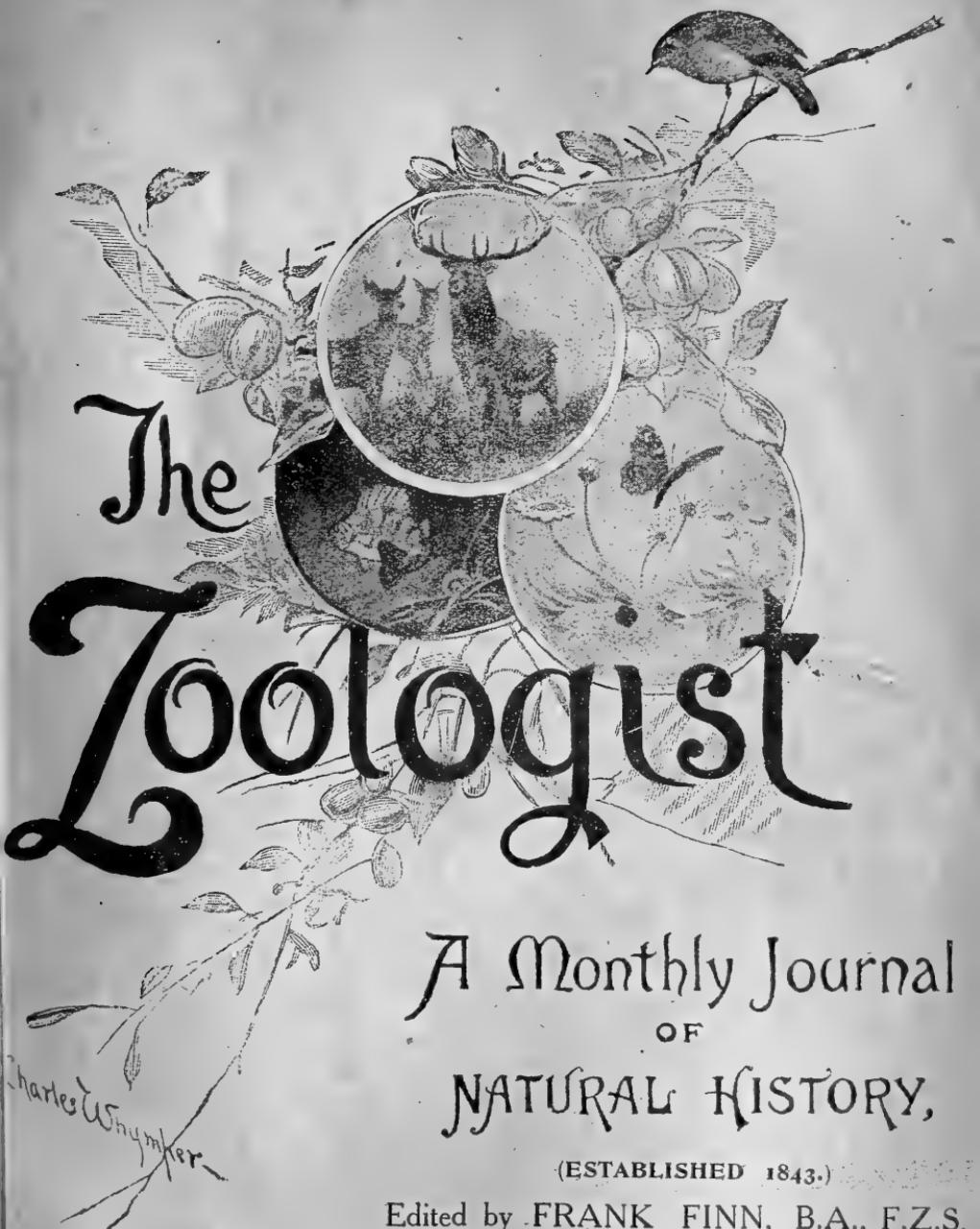
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NEST OF WILLOW GROUSE.



YOUNG OF WILLOW GROUSE.



WILLOW GROUSE, FEMALE.

THE ZOOLOGIST

No. 889.—*July 15th, 1915.*

NOTES ON THE BREEDING HABITS OF THE
WILLOW-GROUSE (*LAGOPUS LAGOPUS*) AT THE
MOUTH OF THE YENESEI RIVER, SIBERIA.

By M. D. HAVILAND.

(PLATE II.)

DURING the summer of 1914, as one of the party of Miss Czaplicka of Oxford, I visited Golchika, the most northerly village of the Yenesei River. The bird-life of the district has many features of great interest to ornithologists, although in that latitude (72°) there was little that was typically Asiatic in the avifauna. Out of the thirty-seven species of birds that I observed there, all but one were represented on the British lists (though in one or two cases by a different subspecies). The only bird not so represented was the Willow-Grouse (*Lagopus lagopus*),* the subject of these notes.

The Willow-Grouse (the “balshaya Kuropatka” or “big partridge” of the Siberians) was frequent on the tundras of the Yenesei estuary, though nowhere very abundant. It was generally to be found in the more marshy spots where a trickle of water ran down a gully and spread into a small swamp which was covered with knee-deep willow scrub. Early in the season when the snow is melting, I imagine that the birds feed largely on the buds of the willow. The crop of a male shot in such a place on July 12th was stuffed full of them. I never saw

* B. O. U. list.

any birds in the drier and barer parts of the country. Even the nests and young broods were always to be met with close to water. The tundra, although for many miles around the river its variations in altitude do not exceed 150 or 100 ft., has most distinctive gradations in avifauna. To take an extreme case: the highest points are occupied by Wheatears, Shore-Larks and Dotterel; the lower and more swampy levels by Red-throated Pipits and Willow-Grouse; while the marshes are full of Divers and Phalaropes. But in that flat country the margins between one environment and another are so fine that you may occasionally see a Dotterel breeding in the same situation as a Snipe might choose; and I have found a Willow-Grouse, which had missed its habitat by perhaps thirty feet and was nesting in the marsh herbage on the river bank.

This nest, which is the one shown in the illustration, was found six miles from Golchika. I spent the night of July 11th in bird-nesting by the light of the midnight sun, and about 11 p.m., my companion, a Russo-Siberian from the south, flushed an "Abba," as the Samoyedes call the bird, from thirteen eggs. She ran from the nest, feigning a broken wing in true Partridge style, and Vassilli immediately fell into the trap. He cocked his gun and ran after the bird, expecting each instant to obtain a better shot. The old Grouse lured him thus out of sight of the nest, and then boomed away unhurt. I never saw a more effective hoax more successfully carried out, and the dupe came back looking very sheepish, with his gun undischarged.

I did not arrive at Golchika until the end of June, and as the birds by then were already mated, I did not see anything of the courtship of the species. From my own observation I should say that the cock bird takes no part in incubation, although he assists afterwards in the rearing of the young. Frequently during the first part of July I flushed a solitary cock bird from the willow on the tundra, the inference being that the females were then upon the nest. The flight and alarm note are so like those of *Lagopus scoticus*, that if I shut my eyes, I could well have believed myself among the heather of a Yorkshire moor instead of some thousands of miles away in the heart of Arctic Asia. On the wing, however, the bird appears

much more conspicuous than the Red Grouse, owing to its skewbald colouring. Birds shot in the middle of July were still moulting their winter plumage.

On July 25th I surprised a pair of Grouse and their brood in a swampy valley, much frequented by Red-throated Pipits and mosquitoes. The "cheepers," which were partly fledged, scattered into the willow scrub. However, I captured a couple and imprisoned them in my camera case. Their calls soon attracted the old bird, who was watching from a knoll not far away, and she ran up to the spot. By the use of a reflex camera and a long-focus lens, I was able to secure a series of pictures of her as she crept round me, puzzled to locate the whereabouts of her distressed brood. Meanwhile, the male bird also approached and testified the greatest anxiety, but he never came near enough to allow me to photograph him. While the young broods are fledging, they are never found far from the neighbourhood of water. Probably, like Plovers, they require to drink and bathe frequently.

Mr. A. Trevor-Battye ('Ice-bound on Kolguev,' p. 430), writing of the habits of this bird on Kolguev Island, says: "On July 30th saw eight cocks together, and from then onwards they continued packing." On the Yenesei I never saw more than two Grouse together at the one time, even in August, when the young birds must have been strong upon the wing. As I have said, the birds were not very abundant. Each likely locality seemed to be inhabited by a single family, and they may well either have escaped notice in that immense country, or else migrated at once to the highlands inland, in search of ripening berries.

I also found the Rock-Ptarmigan (*Lagopus rupestris*) on the tundra about twenty miles from Golchika on July 19th. Two males and a female were shot together from among the willow scrub on a high ridge of the tundra. The birds were very tame, and I saw no sign of nest or young, although the female had an incubation spot. This was the only time that I saw the "malenki Kuropatka," as the Siberians call it, but Seeböhm, who visited Golchika in July, 1877, and whose list of birds of the district is not very comprehensive, records it from close to the river.

The Willow-Grouse is the last bird (with the exception of the Snowy Owl (*Nyctea nyctea*)) to leave the Yenesei estuary before the winter. Mr. Trevor-Battye (*op. cit.*, p. 430) states that this bird winters on Kolguev and forms an important winter food of foxes. I have the authority of the Siberians for the statement that the Willow-Grouse does not winter on the Yenesei below the forest growth. It was still common at the end of August, when most other birds had left for the south, and it was frequent in the Breokoffsky district, about two hundred versts higher up the river, throughout September. The natives said that it sometimes lingered on into October, when the blizzards finally buried the willows.

THE HABITS OF THE FOUR-HORNED SPIDER-CRAB.

By H. N. MILLIGAN, F.Z.S.

OUR knowledge of the habits of the Four-horned Spider-Crab (*Pisa tetraodon*) is exceedingly meagre, partly no doubt because this crustacean is rarely to be seen in aquaria, and the following notes upon the subject may therefore be of interest. These notes are the result of constant observation of about a dozen individuals of this Spider-Crab which have lived from time to time in one or other of the fourteen marine aquaria at the Horniman Museum. Although the facts here recorded relate entirely to these captive individuals, I have tried to add to any usefulness the present paper may possess by referring in their appropriate places to such of the few published records which seem to bear upon those habits I have described.

Bell has drawn attention to the "extremely slow and measured" movements of the Four-horned Spider-Crabs *; but their movements are not only slow, they are remarkable for an exceeding cautiousness. Even after several months of captivity these Spider-Crabs will immediately cease to eat or to walk if the front of one of their aquaria (each of which is thirty-one inches long, eighteen inches from back to front, and fifteen inches deep) be abruptly approached. I have seen individuals which have been engaged in tearing food suddenly stop and remain quite still for several minutes with the food (say a piece of seaweed or a worm) suspended between mouth and outstretched claw, because I have made a sudden movement of my arm in front of the aquarium. They may be seen to behave in this way when on the rocks at the back of the tank, ten or twelve inches away from the glass front, and this suggests that the sight of these Spider-Crabs must be comparatively good. It may be pointed out that the aquaria receive their light from electric lamps above, and that no shadow could fall across the Spider-Crabs from my arm; therefore, it could not be a shadow which alarmed them.

It is to be observed that the behaviour of a Four-horned

* T. Bell, 'A History of the British Stalked-eyed Crustacea,' p. 25.

Spider-Crab differs, in my experience, according to whether the animal is alarmed whilst standing in an exposed situation, or whether it is alarmed in one of its favourite positions, wedged into a hole or clinging closely to the under surface of a projecting piece of rock. If a *Pisa tetraodon* be touched with a rod when in the former position, it at once presses its body as closely as possible to the ground, and then begins to sidle away as quickly as caution permits. If, however, it is in one of the latter positions, it does not usually seek safety in flight, but presses its body tightly against the rock and remains perfectly still, resisting with all its strength any attempt to move it from side to side or to pull it away from the rock. Its behaviour in this respect, as I have frequently satisfied myself by experiment, is the same whether its body carries a disguising mass of seaweeds or not. A Four-horned Spider-Crab may often be seen clinging to the under surface of a jutting piece of rock which would appear to be far too smooth to enable it to obtain a hold, but the comb-like row of spines on the inner margin, and the sharp-pointed tip, of the terminal joint of each of the eight walking legs, enable the animal to obtain a good and very ready grasp. One Spider-Crab hung (for at least a day, I believe) after death to the under surface of such a jutting rock, and it was found that some of the rows of spines had been introduced before death so cunningly into holes and depressions that each leg required to be detached with some care. Carrington and Lovett mention the "very secure" hold of this Spider-Crab, remarking that the sharp end joint can be clenched back upon the next one,* but they do not mention the use of the spines. The sharp point of the end joint and the spines (which are shown in fig. 2) are especially useful when the animal attempts a characteristic method of escaping from an enemy, or from the annoyance of being touched with a rod. If the Spider-Crab is exposed on the rocks when so attacked, it sidles away in the manner described above, but immediately it reaches the edge of the rock it deliberately turns over the edge, and, once beneath, remains perfectly still, clinging upside down.

The attitude assumed by a Four-horned Spider-Crab when at

* J. T. Carrington and E. Lovett, "Notes and Observations on British Stalked-eyed Crustacea," 'The Zoologist,' vol. xxxix, 1881, p. 359.

rest on a horizontal surface is shown in fig. 1. The four pairs of walking legs rest upon the ground, the body being carried obliquely, while the two claws are held in such a way that they resemble inverted V's, and the animal has a peculiarly watchful aspect. Sometimes the anterior and longest pair of walking legs are raised above the ground and stretched out on either side. Very frequently when at rest against a vertical rock the Spider-Crab will place itself in such a position that its body is vertical, the ventral surface of the animal being pressed against the rock, and its hinder portion, together with the three hinder pairs of walking legs, resting upon the ground. The long first



Fig. 1.—An adult female Four-horned Spider-Crab in a characteristic resting and watching attitude. The hairs are not represented.

pair, and sometimes also the second pair, of walking legs are then spread out as straight as possible to right and left of the Spider-Crab. When the Spider-Crab assumes this attitude against a rock it is very difficult to detect the animal. A Spider-Crab may sometimes be found in the morning standing in this posture, not against a rock but against the glass front of the aquarium. If such a Spider-Crab be touched, it presses its body against the glass, just as it would have pressed it against a rock, and then begins to sidle away. It does not sidle away over the floor, but along the glass front, of the aquarium, in spite of the alarm which it must feel when the glass is tapped immediately in front of its eyes as it moves along. It was mentioned above that the Spider-Crab will notice the movement of an arm ten or twelve inches away, and it must be well aware of a finger tapping the glass in front of it. The fact that it will press along the glass front, instead of moving away across the floor of the

tank, shows how deeply rooted is this instinctive attempt to escape an enemy by creeping close to some surface, which would normally be the rock it so much resembles in colour. After eight or nine months in an aquarium the movements of this Spider-Crab are as slow and cautious as when the animal was first introduced, and it never seems to acquire the tameness and confidence so often shown by the Shore-Crab in captivity.

Owing to its olive brown, or sometimes reddish brown, colour, and the irregular surface of its carapace, the Four-horned Spider-Crab is difficult to detect, even when it is standing fully exposed on the brownish rocks of the aquarium. On two or three occasions I have been quite unable to find a certain individual amongst the rocks, even in the small aquarium whose dimensions are given above, and, concluding that it had escaped from the tank during the night, have afterwards found it clinging to the under surface of a rock at which I must have looked in my first survey. It is interesting to note that Aurivillius mentions a somewhat similar experience with *Hyas*.* I wished to find out whether the Spider-Crabs would voluntarily expose themselves on light-coloured sand, upon which their brown bodies would stand out conspicuously, or whether they would avoid it and remain on the rocks with which their colour harmonised. An experiment was therefore made with two individuals which had lived for several months in a tank, the back of which was covered with dull brown rocks and the floor with brown pebbles. The Spider-Crabs were removed to a tank whose back was covered with similar dull brown rocks, and the floor with exceptionally light-coloured sand. It was found that in the second tank the Spider-Crabs, although they exhibited, as in the first tank, a decided preference for sitting amongst the rocks, were nevertheless quite as frequently to be seen on the sand as they had been on the pebbles; and there was no marked avoiding of the sand such as I had certainly expected to find.

It is well known that the different species of Spider-Crabs are in the habit of attaching to their bodies foreign materials which act as disguises. The materials which have been used in

* C. W. S. Aurivillius, "Die Maskirung der Oxyrrhynchen Dekapoden," 'Kongliga svenska Vetenskaps Akademiens Handlingar,' 1 Häftet, No. 4, Band xxiii, 1889-90, p. 11.

the Museum aquaria by the Four-horned Spider-Crab are green and brown seaweeds of various kinds, and *Sertularia operculata*, and *Bugula turbinata*. Other individuals have borne *Halichondria panicea*, *Spirorbis*, and (in two cases) the golden-yellow *Botryllus gemmeus*; but these foreign bodies were already on the Spider-Crabs when they were obtained from the sea. *Aurivillius** records the use of hydroids and algæ, and Carrington and Lovett † the use of *Plumularia falcata*, ‡ *Alcyonium digitatum*, and *Halichondria panicea*. Schmidlein § mentions the use of sponges, *Alcyonium*, *Sertularia*, *Antennularia*, *Flustra papyracea*, and colonies of synascidians in "Pisa-species," but does not specifically mention *P. tetraodon*. One of the individuals observed by me which bore a mass of *Botryllus gemmeus* also carried a white plume of dead *Bugula turbinata*, of about an inch and a half in length, on its carapace; and it may be remarked that the golden-yellow *Botryllus* and the white *Bugula* were so conspicuous that the brown Spider-Crab itself was easily overlooked. The plume of *Bugula* fell off, or was knocked off, the back of the Spider-Crab during the night, and, after lying for a couple of days on the floor of the tank, was replaced by the Spider-Crab. Although the Spider-Crabs will place disguising materials upon their bodies during the daytime, it is after dark that they prefer to work, and it is then they work most quickly. Two females which lived together in an aquarium were given three masses of *Sertularia operculata*, each of about the size of an open hand, at 10 a.m. They examined the *Sertularia*, and seated themselves in the midst of it, but they made only few, and but partly successful, attempts to fasten it amongst their hook-like hairs in the daytime. On the following morning, however, it was found that both were completely enveloped in masses of the hydroid, which they had fastened to their bodies.

The small hook-like hairs upon the carapace and backs of the legs to which the disguising materials are attached have often been described in the different species of Spider-Crabs. It should, however, be observed that the seaweeds and hydroids

* *Op. cit.* p. 49. † *Loc. cit.* p. 359. ‡ = *Hydrallmania falcata*.

§ R. Schmidlein, "Beobachtungen über die Lebensweise einiger Seethiere innerhalb der Aquarien der Zoologischen Station," 'Mittheilungen aus der Zoologischen Station zu Neapel,' Erster Band, 1879, p. 23.

and other disguising materials in the Four-horned species (at all events in those studied by me) are not spitted by the Crab on the hooks, or roughly entangled in them, as seems to be often imagined; though it is possible that materials are sometimes caught on the hooks of a passing Crab, and I have seen a flat piece of the thin green *Ulva lactuca* really spitted on two of the hairs of the leg of one individual. The hooks are not scattered



Fig. 2.—Outline of the body and right limbs of an adult female Four-horned Spider-Crab, mainly to show the tracts of hook-like hairs and the way in which weed is thrust into two of the alleys. The other hairs are not shown.

over the surface of the body but form regular tracts, whose arrangement is shown in fig. 2. It will be seen that the hooks of each tract tend to form "alleys," the hooks of opposite sides of an alley generally facing inwards. The thin ends of the disguising materials are, as a rule, thrust along the alleys made by these opposed hooks, and if one of the Four-horned Spider-Crabs be examined it will usually be found that the material can easily be moved in and out of an alley. In the case of flat pieces of seaweed which are too large to be thrust into an alley, one corner of the weed is usually twisted round in a spill-like manner, and the narrow piece so formed is thrust into the alley. The hooked

hairs on and in the region of the rostrum form two especially long and strong rows, and it is here that the largest and heaviest masses of seaweed are placed by the Spider-Crab. Indeed, the disguising material fastened on this region is usually of such a length that it stands out, often for as much as four inches, in front of the head in a peculiar and characteristic manner. The *Halichondria*, *Spirorbis*, and *Botryllus* mentioned above were actually attached to, and growing upon, the Spider-Crabs, but in all the other examples which I have been able to examine, the ends of the disguising materials were merely thrust in the alleys; and it is doubtful whether the Spider-Crabs had placed upon themselves any of these three animals, the two last not being attached by hooks at all, but lying flat on the hinder part of the carapace. Bell declares that there is no doubt that plants actually grow upon *Pisa tetraodon*, and are attached by roots,* and other writers have adopted this statement. In specimens preserved dry the disguising materials are often stuck upon the body of the Spider-Crab in such a way as to give the impression on slight examination that in life they actually grew on the crustacean. The point deserves investigation by one who can study numerous fresh specimens. Aurivillius, who gives a description of the distribution of the hooks in *P. tetraodon*, and a figure of their arrangement in *P. armata*, says † of the former species: “Die untersuchten Exemplare sind mit Hydroiden oder Algen reichlich maskirt; es sind dabei die Doppelreihen der Rostralhäkchen zur Befestigung wahrer Federbüschle von Hydroiden verwendet, deren Spitzen allesamt nach vorne frei hervorstehen, die abgebrochenen Enden nach hinten in die Furche zwischen den Häkchenreihen gelegt.” ‡

There appears to me to be little doubt that the arrangement of the hooks in alleys not only affords the Spider-Crab a ready means of affixing disguising materials upon its body, but also of enabling it to escape by sudden detachment of the materials if they should be seized by an enemy. Their use in the latter

* *Ibid.* p. 25.

† *Op. cit.* p. 49.

‡ “The specimens examined are richly masked with hydroids and algae; the hydroids are fastened to the double series of rostral hooks in the manner of feather-brushes whose points all stand out freely in front, while their broken ends lie in the furrow between the series of hooks behind.”

way can readily be tested by taking hold of the disguising mass and giving it a gentle pull, when a portion of it will usually come away in the fingers, the animal at the same time sidling off in the opposite direction. Indeed, it is often sufficient simply to seize the mass, when the Spider-Crab will itself give a pull in order to get free. It is usually the long outstanding mass on the rostrum which is presented to the enemy as the Spider-Crab retreats with its peculiar sidelong gait.

The Four-horned Spider-Crab feeds readily upon seaweeds of various kinds. It will eat in the daytime, especially if it is hungry, but it is after nightfall that it prefers to feed. The quantity of seaweed devoured may be measured by the rapid disappearance of the seaweeds in the aquarium and by the masses of faeces daily deposited. It may here be mentioned that on one occasion, when there was a shortage of seaweed for a few days, two Spider-Crabs which were living in a tank at that time were given some of the common freshwater Canadian weed (*Elodea canadensis*), which they cut up and ate. Bell mentions that these Spider-Crabs would congregate in vast numbers in the prawn and lobster pots at Bognor, attracted, he thought, by the garbage used as bait ; * but I have never been able to get any of them to eat raw beef, and only occasionally, and reluctantly, to take dead fish. All the individuals studied by me have been females, or males whose claws had not attained their full size ; and it is possible there may be some difference between the habits of the younger and older Spider-Crabs, or between those of the males and females, the adult males being bold enough to approach and feed upon substances likely to attract animals which might attack the *Pisa* itself, while the younger males and females venture only to take food which can be obtained with less risk. Indeed, Bell remarks† that those found in the pots were much larger and finer than any he had seen elsewhere. I have observed that the masses of seaweed used as a disguise may also serve as a food-reserve if the animal is unable to obtain sufficient to eat. One individual, for example, enveloped itself in a mass of seaweed some four inches in height, and it gradually removed and ate the whole mass in the course of the following fortnight. Schmidlein mentions ‡ that he has seen “ *Pisa* -

* *Ibid.* p. 24.

† *Ibid.* p. 24.

‡ *Loc. cit.* p. 23.

species" in the aquarium at Naples trimming and plucking off one another's hydroids and sponges to use as food.

Although they would not take beef, I found that the Four-horned Spider-Crabs would, in the absence of seaweeds, sometimes eat dead or dying *Sabellæ*, and also, though not eagerly, garden worms. The *Sabella* was usually removed from its tube before being given to the crustaceans, but on one occasion there was placed in an aquarium, which contained three adult female Spider-Crabs, a healthy living *Sabella* in its leathery tube, which was about four and a half inches in length and one sixteenth of an inch in diameter and firmly attached to a shell. A female *Pisa* which happened to walk over the shell immediately seized the *Sabella* with its two claws and tore the worm into two parts at about an inch and a half from its attachment to the shell, in much the same way that a man would twist and tear a piece of paper across. The Spider-Crab then lifted the loose, larger part in one claw, placed the proximal end in its mouth, and proceeded deliberately to eat along the tube. As fast as the lower end of the tube was bitten off by the Spider-Crab, the worm moved out of its tube through the opening at its upper end. The Spider-Crab now turned the tube round; the worm retreated almost wholly into the remaining part of its tube;* the Spider-Crab then pinched the tube tightly with both its claws in such a way that the worm was held firmly and was unable to move upwards or downwards in its tube, about half the length of the massed gills hanging limply out. It is difficult to decide whether this process of imprisonment of the worm by pinching its tube was an instinctive or accidental action on the part of the crustacean. The Spider-Crab again began to eat along its prey, biting through worm and tube together. About half an hour after seizure of the worm the Spider-Crab had disposed of all but about an inch of the upper end of the tube and the gills. It now held out the remainder of the tube at arm's length in the characteristically indifferent manner in which these Crabs hold out unwanted food which they have picked up and are about to throw away again. On looking at the Spider-Crab about three hours later, however, I could not see any trace of the worm or

* The *Sabella* is considerably shorter than its tube.

its tube, and presume the crustacean had eaten them, though it is probable that the gills had simply been broken up and scattered amongst the pebbles and had not actually been swallowed. By this time the crustacean had travelled for a distance of about a foot from the place where it began its meal, and the proximal inch and a half of empty tube still remained projecting from the shell to which it was attached. By the next morning this piece also had disappeared, having, I suppose, been eaten by the same, or another, Spider-Crab.

A few days later a *Sabellida pavonia* in a tube of about nine inches in length and less than a quarter of an inch in diameter was placed on the floor of the same aquarium. The widely-spread gills and a very small portion of the body of the worm were protruding from the tube, when a female *Pisa* slowly and quietly approached and took hold of the exposed part of the body of the worm, immediately beneath the gills, with its left claw. It is remarkable that a *Sabellida*, which usually darts back into its tube on the slightest alarm, should have suffered itself to be caught by so slow and clumsy an enemy as a Spider-Crab, but perhaps the pressure of my fingers on the lower part of its tube, when I was carrying it to the aquarium, had made the worm reluctant to withdraw. The Spider-Crab now began to tear off the gills of the worm in bunches of two, three, or four, with its right claw, and to hold them to its mouth and bite them, although, apparently not finding them palatable, it did not swallow them. After tearing off, attempting to eat, and rejecting, several bunches in succession, the Spider-Crab stopped. In the meantime the worm had made frequent violent attempts, which were sufficiently vigorous to cause its tube to swing about in the water, to jerk itself into safety further in its tube. The Spider-Crab now seemed not to care to resist these attempts, although it did not release its grasp of the worm, and presently the latter had pulled itself so far down the tube that the Spider-Crab looked as though it had a very long sleeve on its claw. When, however, it began, two or three minutes later, to walk away over the rocks, it apparently found this sleeve inconvenient, and, withdrawing its limb, it allowed the tube to fall to the ground. The tube lay untouched on the floor for several days, but when I took out the worm and gave it to one of the Spider-Crabs it was

readily eaten. In the case of the first-mentioned tube the Spider-Crab dropped most, perhaps all, of it as it bit through it. After the worm had been taken from the second tube, the latter was cut up into several short lengths and thrown back into the aquarium. They lay untouched on the floor of the tank for three weeks, and it may therefore be concluded that the Spider-Crab will bite through the tube only in order to reach the worm, and not in order to eat the tube itself. I have seen a Spider-Crab tearing and eating two ascidians, each of which was about an inch and a quarter in length.

On the night of February 17th-18th, 1915, a number of bright vermillion eggs were laid on one of the horizontal rocks in the aquarium containing the three female Four-horned Spider-Crabs mentioned above. The tiny eggs were not in a mass, but were thinly spread, and gave, when I first caught sight of them on the morning of the 18th, the impression that some paint had been splashed over the rock. I estimated their number at about 2500. One of the Spider-Crabs, which may or may not have been the mother, was standing over the eggs and shovelling them into her mouth with her claws in her usual slow and deliberate manner. About an hour afterwards another individual joined the first and also began to eat the eggs. The Spider-Crabs were driven away, but they returned later. The eggs rapidly dwindled in number under these attacks, and on the 22nd there were only a few, which had fallen into holes and cracks, to be seen. The worm-shaped faeces of the Spider-Crabs were tinged with vermillion during these few days. About two or three hundred more eggs were laid in the same tank on the night of February 24th-25th, but they were all eaten by the Spider-Crabs, and none were to be seen by the 27th. On the night of May 14th-15th, about a thousand vermillion eggs were laid, and these also disappeared speedily, though in this case I did not actually see the Spider-Crabs eating them. The two last lots of eggs were littered over the rocks, as the first had been, and were not in masses. I examined each female whenever eggs were deposited, carefully turning back the abdomen in order to do so, but in no case did I find any eggs retained between the thorax and the abdomen. On March 26th the same Four-horned Spider-Crabs were offered a mass of eggs

which had been obtained from the abdominal limbs of a female of the Common Spider-Crab (*Hyas araneus*). About half of these eggs were eaten by the Four-horned Spider-Crabs, but they did not seem to eat them with the same avidity as they had eaten their own. Perhaps the fact that the eggs of the *Hyas* were not fresh, but well advanced in development, may have had something to do with this. A number of eggs, which were nearly ready for hatching, of the Sea-bullhead (*Cottus bubalis*) were refused altogether.

It is familiar to those who have kept in aquaria certain crustaceans, such as the Shore-Crab, the Velvet Crab, the Crayfish, and the Common Prawn, that these animals will select convenient holes or corners amongst the rocks which they use as permanent resting places, from which they only venture to get food, and to which they retreat when alarmed. None of the Four-horned Spider-Crabs observed by me have had such special resting places. They will remain almost motionless during the daytime in one spot, but after dark they move away to feed, and then retire to a fresh place when daylight returns. This is, of course, intelligible when it is remembered that the Spider-Crab carries a disguising mass of seaweed, while the Shore-Crab, Crayfish, and Prawn have no such protection.

Bell says of the Four-horned Spider-Crabs that, "notwithstanding their timid and lazy character, they seize the object of their anger by a sudden and unexpected snap, and nip with great force, holding on with extraordinary firmness and tenacity, although unable, from the bluntness of their pincers, to inflict a wound."* None of the females or small-clawed males observed by me have attempted to bite or to strike with their claws, however much they were annoyed, and I have frequently taken fresh and healthy individuals in my fingers for examination without their making any hostile demonstration. The females, for example, whose abdomens I turned back in order to look for eggs, made no attempt to defend themselves. Bell's remarks may perhaps refer only to adult males, in which the claws are much larger than they are in females and immature males.

* *Ibid.* p. 25

THE "LAPILLUS" IN FISHES.

By COLONEL C. E. SHEPHERD (Indian Army).

"LAPILLUS" is the name given by scientists to that otolith found in the *recessus utriculi* portion of the ear-labyrinth of teleostean fishes. Up to the present time no special notes seem to have been published regarding this stone. The "Astericus" was treated of in the 'Zoologist' for February, 1910; and many sagittæ are shown, and their peculiarities, when out of the common, pointed out, in the 'Zoologist' for August, 1910; in the March and April numbers for 1914, and January, 1915. In the illustrations of the four latter papers many figures of lapilli are incidentally shown, but this stone is, as a rule, so small that nothing definite is seen; some enlarged drawings may enhance interest in them. The purpose they fill and the need of their presence in the auditory labyrinth of a fish is at present indeterminate. They have a variety of forms; Mr. Higgins,* who made a collection of otoliths about the middle of last century, calls the lapillus "the superior otolite" (*sic*), because it occupies a spot in the brain-cavity of a fish a little above the other otoliths. He says of the lapillus that it is "usually more globose, smaller" (compared to the sagitta, he means), "and rather porcellanous, and varies considerably in form, being rounded, triangular, stellate, or hastate." To which may be added, some resemble closely the shape of a seed in the grape. The place of the lapillus in the *Acipenseridae*, as exemplified in *Acipenser sturio*, is taken by otoconia (ear-dust) instead of a solid otolith (ear-stone); the otoconia † being separate crystals of carbonate of lime.

In the present paper it is as well to take first those fishes that have a palpably large lapillus. The first family, then, to be reviewed is the

CERATODONTIDÆ.

The lapillus in *Neoceratodus fosteri* (fig. 1), the "Burritt Salmon" of Queensland, Australia, is of good size,

* See Jour. Linn. Soc. vol. ix. No. 35, January, 1867.

† Illustrated in 'Zoologist,' January, 1915.

slightly concave on the outer face, coming to a point at the posterior end, and having, in the specimen obtained, on the lapillus from the right side of the head an excrescence like a minute hillock in the concave plain at the anterior end. In another specimen, in the Royal College of Surgeons Museum, this minute hillock has a hook-like shape. The otoliths in these specimens are of a very chalky texture, and the markings do not show very plainly.

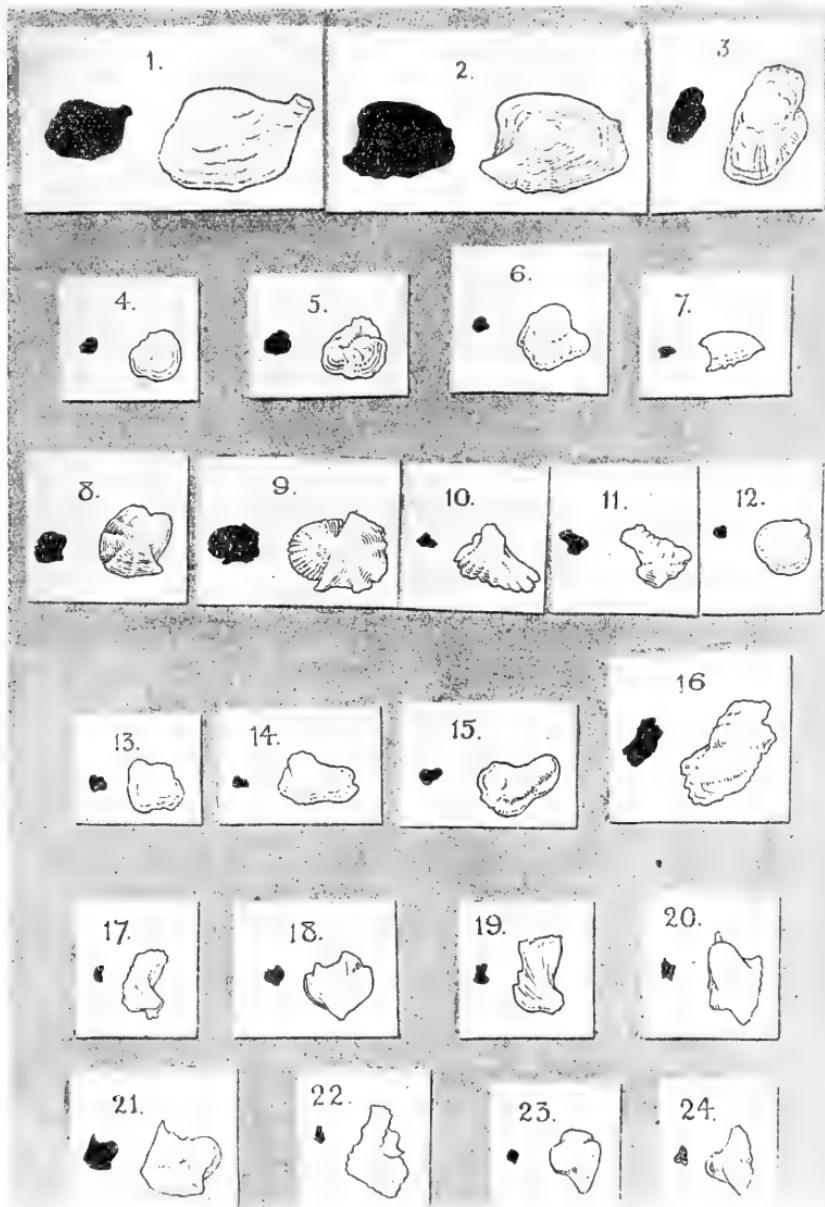
Next in order may be taken those fishes in which the lapillus is the largest of the three otoliths on one side of the head; this occurs in the *Mormyridæ*, *Hyodontidæ*, *Siluridæ*, and *Loricariidæ*. Beginning again with those that have the largest lapillus, the first family to be described is the *Siluridæ* or Catfishes.

SILURIDÆ.

In the marine members of this group the lapillus is a really big stone, whilst some of those living in fresh water have, for the size of the fish, a very small one. A contrasting instance is given in the 'Zoologist' for January, 1915. The lapillus of *Arius buchanani* (fig. 2) is a large stone; it is the same with all the *Ariidæ* and the allied genus *Ælurichthys*. The lines of growth in the specimen figured, and also in others of the family, are plainly visible owing to the size of the stone. In other fishes, the stone being small, these lines do not show as a rule. *A. gagora* has a large stone semi-globular as to one-half, the other half stretched out at its outline and coming to a blunt edge. *Ælurichthys gronovii* has a stone with one part of its outline projecting into a distinct point. *Platystoma fasciatum* also has a large lapillus (fig. 3) differing considerably in shape from those of the *Arius* family. The lapillus of *Bagarius yarrellii*, a fish found in the rivers of India, is particularly small viewed in relation to the size of the fish. *Synodontis schall*, a Siluroid from the Nile, has but a small lapillus.

MORMYRIDÆ.

Mormyrus kannume (fig. 4), a fish from the Nile, has a lapillus of a roughly circular outline, although it is the largest of its three otoliths; it is moderate in size considering the size of the fish.



LAPILLI.

1. *Neoceratodus fosteri*.
2. *Arius buchanani*.
3. *Platystoma fasciatum*.
4. *Mormyrus kannume*.
5. *Hyodon alosoides*.
6. *Megalops atlanticus*.
7. *Osteoglossum bicirrhosum*.
8. *Myletes ellipticus*.
9. *Leuciscus cephalus*.
10. *Murænesox talabon*.
11. *Polynemus tetradactylus*.
12. *Macrurus investigatoris*.
13. *Gadus morrhua*.
14. *Lutjanus annularis*.
15. *Lopholatilus chamaeleonticeps*.
16. *Sciaena carutta*.
17. *Sciaena maculata*.
18. *Pagellus erythrinus*.
19. *Drepane punctata*.
20. *Oosphromenus olfax*.
21. *Caranx malabaricus*.
22. *Sarda mediterraneus*.
23. *Psettodes erumei*.
24. *Trigla cuculus*.

HYODONTIDÆ.

The lapillus of *Hyodon alosoides* is shown enlarged (fig. 5). It is fairly developed for the size of the fish.

The following fishes to be described do not belong to those in which the lapillus is the largest of their otoliths :—

ELOPIDÆ.

Megalops atlanticus (the Tarpon) has a very well developed lapillus (fig. 6), of roughly circular outline, with a dent in part of it.

OSTEOGLOSSIDÆ.

The only specimen of a lapillus obtained in this family was got from the head of *Osteoglossum bicirrhosum*, the "Aroowana" of British Guiana ; it is a small stone of triangular shape (fig. 7).

OSTARIOPHYSI.

The *Siluridæ* have been dealt with above. The lapillus in the families of the *Characiniidæ* and *Cyprinidæ* occupies the second place in size of their three otoliths. It is generally of a fair size ; in some cases it may even be classed as large.

CHARACINIDÆ.

Myletes ellipticus, the "Pacu" of British Guiana (fig. 8), has a lapillus of fair size, enabling the lines of growth to be distinctly traced. The lapillus of *Macrodon trahira*, the "Haimara" of British Guiana, is of elongated shape. That of *Erythrinus salmoneus*, called the "Yarrow" in British Guiana, assimilates more in shape to that of *Myletes*.

CYPRINIDÆ.

Leuciscus cephalus (the Chub) has a particularly solid lapillus (fig. 9) which has two little projections, one terminating as a slight hook. An extra lapillus was found in the right half of the cranium of a *Leuciscus dobula* (the Dace) ; in a specimen examined it is mentioned as being most abnormal. There were two lapilli in the labyrinth of the right side and one in that of the left side.

APODES.

Murænesox talabon, called the "Koolaree" by the Tamil fishermen at Madras (fig. 10), has a well-developed lapillus,

shaped like a grape-seed. In *Conger vulgaris* it is a well developed stone also.

POLYNEMIDÆ.

Polynemus tetradactylus, called the "Mangoe" fish at Calcutta (fig. 11), has a fairly large lapillus for the size of the fish, and the largest in this family. In *P. indicus*, *P. plebeius*, and *P. sextarius* the lapilli decrease in size in the fishes in the order named.

MACRURIDÆ.

In *Macrurus investigatoris*, from the Indian Ocean (fig. 12), the lapillus is small, of a generally circular shape, with a feeble double projection at one side.

GADIDÆ.

In this family the lapillus is not correspondingly developed to the size of the sagittæ. *Gadus morrhua* (the Cod) (fig. 13) has one of a roughly quadrate shape and rather lumpy.

SERRANIDÆ.

The lapillus of *Lutjanus annularis* is of a grape-seed shape (fig. 14); this should be given a quarter of a turn to the right to get the shape defined.

PSEUDOCHROMIDÆ.

Lopholatilus chamæleonticeps (the Tilefish) (fig. 15) has, compared to its sagitta, but a very moderately-sized lapillus, of a grape-seed shape.

SCIÆNIDÆ.

In this family the lapilli vary in size; some have a large one, e. g. *Sciæna carutta* (fig. 16), of oblong shape, with a concave border one side, whilst others have a comparatively small one, e. g. *S. maculata* (fig. 17); both these specimens came from the Indian Ocean, and in the adult stage grow to much the same size.

SPARIDÆ.

Pagellus erythrinus (fig. 18). The outline of the stone comes to a pointed projection in one part. *P. centrodontus* (the Sea Bream) has an oblong outline with a projection at one angle. *Box salpa*, a Mediterranean fish, has a solid little lumpy stone with a projection adhering to it. *Pagellus mormyrus*, also from the Mediterranean, is similar in shape to *P. centrodontus*, but

without the projection. *Sargus rondoletti*, from the Mediterranean, is similar in shape, with the corners more rounded as to three of them, the fourth making a projecting point.

DREPANIDÆ.

Drepane punctata (fig. 19). The stone is of a grape-seed shape.

OSPHROMENIDÆ.

Osphromenus olfax (the Gourami) from Java (fig. 20) has a very small lapillus of an irregular rhombic shape, with one corner running into a little spike.

CARANGIDÆ.

The lapillus of *Caranx malabaricus* (fig. 21), from the Indian Ocean, is of fair size and has two jutting-out spikes from one corner, with another corner rounded; it is roughly quadrate. *C. trachurus* (the Horse Mackerel) has a grape-seed-like lapillus.

SCOMBRIDÆ.

The lapillus in this family, like the other otoliths, is small. *Sarda mediterraneus* (fig. 22) has it of a pear shape.

PLEURONECTIDÆ.

In this family the lapilli are small. *Psettodes erumei* (fig. 23), from the Indian Ocean, has its lapillus shown; the shape is difficult to describe.

TRIGLIDÆ.

Trigla cuculus (fig. 24) (the Red Gurnard) has a pear-shaped lapillus. That of *T. gurnardus* (the Common Gurnard) assimilates to the same shape.

The accompanying illustration has been arranged to show the small black outlines, as nearly as possible, of the natural size of the lapilli illustrated. The larger drawing at the side of each is not to scale, but enables some of the markings and sculpturing to be appreciated.

A CATALOGUE OF THE LAND AND FRESHWATER
MOLLUSCA OF SUSSEX.

By E. W. SWANTON.

(Member of the Conchological Society; Curator of the Educational Museum,
Haslemere.)

(Continued from p. 181.)

LIST OF SPECIES
(INCLUDING PLEISTOCENE AND HOLOCENE RECORDS).

Testacella haliotidea, Drap.—Occurring only in gardens and nurseries, therefore probably an introduced species. Rother District (Rev. E. N. Bloomfield); Cornwallis Park, Hastings (E. A. Butler); garden at Park Crescent, Brighton (R. M. Christy, 'Zoologist,' 1880, p. 367); garden at Ratham, near Chichester (W. Jeffery); Lewes (T. S. Hillman).

Var. *major*, G. & F.—Alman's Nurseries, Horsham (J. Whitaker).

T. scutulum, Sowerby.—Occurring in similar situations to the preceding, and probably an alien. Mr. W. Jeffery introduced it in 1881 into his garden at Ratham, Chichester; Lewes (J. H. Jenner); Hastings (Butler); Rectory garden at West Stoke, near Chichester (Rev. W. A. Shaw); Horsham (R. D. Darbshire); Bognor (H. L. Guermonprez).

Var. *aurea*, Cockerell.—Horsham (R. D. Darbshire).

Limax maximus, L.—Generally distributed in woods and near houses.

Var. *cinereo-niger*, Wolf.—Up Park (W. Jeffery, J. C. v. 134); Stoughton (Rev. W. A. Shaw).

Subvar. *ornata*, Lessona.—Up Park (W. Jeffery).

Var. *concolor*, Pini.—Worthing (T. D. A. Cockerell).

Var. *cellaria*, D'Argenville (= *maculata*, Picard).—Bognor (H. L. Guermonprez); Blackdown (E. W. S.).

Var. *krynickii*, Kaleniczenko (= *johnstoni*, Moquin-Tandon).—Bognor (H. L. Guermonprez).

L. flavus, L.—Generally distributed.

Var. *maculata*, Kaleniczenko.—Considered by Taylor to be a subvar. of *umbrosa*, Phil. Ratham, Chichester (W. Jeffery).

L. arborum, Bouchard-Chantereaux.—Widely distributed in woods and parks, especially abundant in beech plantations.

Agriolimax agrestis, L.—Common throughout the county. Mr. J. P. Johnson found it in Pleistocene deposits on the foreshore at West Wittering.

Var. *albitentaculata*, Dum. & Mort. (= *alba*, Cockerell).—Ratham, Chichester (W. Jeffery).

Var. *nigra*, Morelet.—Ratham (W. Jeffery); garden in Queen's Park Road, Brighton (F. G. S. Branwell).

Var. *lilacina*, Moquin-Tandon.—Midhurst (T. D. A. Cockerell); gardens at Blackdown House (E. W. S.).

A. laevis, Müller.—Apparently rare, but probably often overlooked. It is an active species, occurring chiefly in the vicinity of water. It exhibits remarkable sex changes: at first unisexual and purely female, it becomes hermaphrodite, and finally purely male by the atrophy of the female organs. Mr. P. J. Johnston found it in the Pleistocene deposit on the foreshore at West Wittering. Ratham, near Chichester (W. Jeffery); near Liphook (Rev. S. Spencer Pearce); Blackdown (E. W. S.); Charlton Forest (E. W. S.).

Milax sowerbyi, Féruccac.—A local species; easily recognized by the prominent and pale dorsal keel. Lewes and Battle (J. H. Jenner); Ranscombe (C. H. Morris); Little Common, near Bexhill (Rev. W. A. Shaw); Hastings, rare (Rev. E. N. Bloomfield); Ore (A. E. Craven); garden in Queen's Park Road, Brighton (F. G. S. Branwell); not uncommon about Henfield and at Hassock's Gate, near Hurstpierpoint (W. Borrer); common in the Weald and also on the South Downs (J. E. Harting); Bognor (H. L. F. Guermonprez); near Pulborough (E. W. S.); West Stoke, near Chichester (Rev. W. A. Shaw).

M. gagates, Draparnaud.—Rare, recorded only from the neighbourhood of Hastings. It differs from its congener in the darker colour and dark dorsal keel. Hastings (Miss E. B. Fairbrass); East Rother District (J. H. Jenner).

Vitrina pellucida, Müller.—Generally distributed.

Var. *depressiuscula*, Jeffreys.—Hastings and St. Leonards (Langdon's 'Natural History of Hastings,' 1878, p. 13) ; near Hastings (Hastings Philosophical Society).

Vitrea crystallina, Müller.—Generally distributed. Mr. J. P. Johnson found it in a buried river deposit on the foreshore at West Wittering.

V. cellaria, Müller.—Generally distributed. It has been found in Holocene deposits at Eastbourne and at Cissbury.

Var. *albina*, Moquin-Tandon.—Landport, near Lewes (C. H. Morris) ; West Stoke (Rev. W. A. Shaw).

Var. *margaritacea*, Schmidt. Landport, near Lewes (C. H. Morris).

Var. *compacta*, Jeffreys.—Steyning (Rev. C. E. Y. Kendall).

V. rogersi, B. B. Woodward (= *Zonites glaber*, Jeffreys).—Rare. Eastbourne (F. H. Sikes) ; Guestling (A. J. Alletsee) ; Charlton Forest (E. W. S.) ; East Dean (C. E. Wright) ; Cowdray Park (E. W. S.).

V. alliaria, Miller. Generally distributed, the most abundant representative of the genus on the Vectian sands.

Var. *viridula*, Jeffreys.—West Stoke, uncommon (Rev. W. A. Shaw).

V. nitidula, Draparnaud.—Generally distributed. Recorded by Mr. J. P. Johnson from the buried river deposit on the foreshore at West Wittering.

Var. *helmi*, Alder.—Lewes (C. H. Morris) ; Up Park and West Stoke (Rev. W. A. Shaw).

V. pura, Alder.—Generally distributed.

Var. *margaritacea*, Jeffreys.—Lewes (C. H. Morris) ; Ashcombe plantation (J. H. A. Jenner) ; Chichester district (W. Jeffery) ; Valewood Park, near Haslemere (E. W. S.).

V. radiatula, Alder.—Generally distributed.

Zonitoides nitidus, Müller.—A gregarious species, locally abundant in marshy situations. Mr. J. P. Johnson found it in the Pleistocene deposit exposed at low tide on the foreshore near West Wittering, at the extremity of Bracklesham Bay. Ouse, Cuckmere, and East Rother districts, not common (J. H. Jenner) ; Malling Marshes and Landport, Lewes (Jenner) ; by the ditches in the levels at Lewes, rare (W. C. Unwin) ; Pevensey Level

(Ralph Tate and E. A. Butler); Arundel and Chichester district (W. Jeffery); Bognor (H. L. Guermonprez).

Z. excavatus, Bean.—A rare species. A single specimen under dead fir-bark in St. Leonards Forest (W. Borrer); Piplye, Horsted Keynes (W. Whitwell); stream side, Rowfant, Tilgate Forest (E. Saunders); Midhurst (W. Jeffery).

Euconulus fulvus, Müller.—In damp situations throughout the county. Mr. J. P. Johnson noted it in the river-bed deposit at West Wittering.

Arion ater, Linné.—Generally distributed.

Var. *albo-lateralis*, Roebuck.—Singleton, near Chichester (W. Jeffery).

Var. *castanea*, Dum. & Mort.—Ratham, Chichester, not uncommon (W. Jeffery); around Heyshott (E. W. S.).

Var. *plumbea*, Roebuck.—Near Liphook (Rev. S. Spencer Pearce); near Pulborough (E. W. S.).

A. subfuscus, Drap.—Very local; common on the Vectian sands. Charlton Forest (E. W. S.); Bognor (H. L. F. Guermonprez); Henley, near Midhurst (E. W. S.); Blackdown (E. W. S.); Up Park (W. Jeffery).

Var. *cinereo-fusca*, Drap.—Up Park (W. Jeffery).

A. intermedius, Normand (= *A. minimus*, Simroth).—This species and the preceding are probably of much greater frequency than indicated by the records. It is the smallest British representative of the genus, very distinctive in the pointed rugosities (each with a projection on the apex) arranged in symmetrical rows. Charlton Forest (E. W. S.); Verdley, near Midhurst (E. W. S.); Blackdown (E. W. S.); near Liphook (Rev. S. Spencer Pearce). “This doubtful species is included in the Hastings list without locality” (Jenner).

A. hortensis, Féruccac.—Generally distributed.

Var. *subfusca*, C. Pfeiffer.—Gardens at Blackdown House (E. W. S.).

A. fasciatus, Nilsson (= *A. circumscripatus*, Johnston).—Probably often confused with the preceding species. Ore and Coghurst (Craven); Frant (E. W. S.); Charlton Forest and about Heyshott (E. W. S.); Worthing and Pulborough (E. W. S.); garden at Ratham, and Up Park (W. Jeffery); Verdley, near Midhurst (E. W. S.).

Var. *subfuscata*, Roebuck.—Blackdown (E. W. S.).

Punctum pygmæum, Drap.—Frequent on the Downs. Mr. J. P. Johnson found it in the Pleistocene deposits at West Wittering. Lewes Downs, under chalk stones (J. H. A. Jenner and W. C. Unwin); Ashecombe plantation (Eastbourne Nat. Hist. Soc.); among leaves at Hurstmonceaux (Hastings Phil. Soc.); "Hastings (Diplock's Guide), not recently found" (J. H. A. Jenner); Hassocks (P. F. Kensett); Cowfold, near Horsham (W. Borrer); Harting (J. Weaver); Downs above Heyshott and Cocking (E. W. S.); about Chanctonbury Ring and Cissbury (E. W. S.).

Sphyrapodium edentulum, Drap.—Locally abundant. Chailey Common, Lewes, rare (W. C. Unwin); Downs, Lewes (J. H. A. Jenner); Cow Gap, Eastbourne (Eastbourne Nat. Hist. Soc.); Cowfold (Borrer); Bognor (H. L. F. Guermonprez); Harting (J. Weaver).

Pyramidula rupestris, Drap.—Widely distributed on old walls.

Var. *umbilicata*, Montagu.—Ratton, near Willingdon (G. K. Gude).

P. rotundata, Müller.—Generally distributed. Mr. J. P. Johnson records it from the buried fluviatile deposit on the foreshore at West Wittering; and the Rev. W. A. Shaw has found it in a Holocene bed at Kingley Vale, West Stoke.

Var. *alba*, Moquin-Tandon.—Ranscombe and Landport, near Lewes (C. H. Morris); Wannock, near Eastbourne (Rev. S. S. Pearce); between the links and Compton Road, Eastbourne (Jenner); West Stoke (Rev. W. A. Shaw).

Monst. *scalariforme*.—Ringmer (T. S. Hillman).

P. ruderata, Studer.—This species differs from the preceding in the more produced spire, fewer whorls, and absence of reddish-brown freckles. Unknown in Britain in the living state. Mr. J. P. Johnson records it from the old river-bed at West Wittering. It has also been found in Pleistocene deposits in Kent, Essex, and Cambridge.

Helicella virgata, Da Costa.—Widely distributed; very abundant on the Downs. It shows great variability in size and markings. Specimens an inch in diameter were collected by the Rev. S. S. Pearce in cultivated fields at Eastbourne; large

specimens have also been recorded from Lewes by Mr. Jenner, and from Chichester by Mr. Jeffery. Minor forms have been observed on the Lewes Downs (T. S. Hillman) and about Hastings.

Var. *alba*, Bouchard-Chantereaux.—Newhaven (Jenner); roadside near Glynde (Jenner); Winchelsea; Friston; near Eastbourne (C. H. Morris); Rodmell, near Lewes (C. H. Morris); near Bexhill (Rev. W. A. Shaw).

Var. *nigrescens*, Grateloup.—Lewes (Jenner); Winchelsea (specimen in the Rufford collection, Hastings Museum); near Beachy Head, and in Kingley Vale, near Chichester (Rev. W. A. Shaw).

Var. *leucozona*, Taylor.—Wilmington (Jenner); Winchelsea (Hastings Phil. Soc.).

Var. *hypozona*, Moquin-Tandon.—Seaford and Alfriston (J. H. A. Jenner); Winchelsea (A. J. Alletsee).

Var. *submaritima*, Jeffreys.—Winchelsea (A. J. Alletsee); "a form approaching this colouring occurs on the Lewes Downs" (Jenner); Downs above Heyshott (E. W. S.).

Var. *subalbida*, Poiret.—"Seaford, Newhaven, and several other localities" (J. H. A. Jenner); Downs about Cissbury (E. W. S.); Chilgrove, near Chichester (Rev. W. A. Shaw); Downs above Heyshott (E. W. S.).

Var. *albicans*, Grateloup.—Seaford and Newhaven (Jenner); Lewes (C. H. Morris); Winchelsea (A. J. Alletsee); Chilgrove, near Chichester (Rev. W. A. Shaw); Downs above Heyshott (E. W. S.).

Var. *radiata*, Hidalgo.—Winchelsea (A. J. Alletsee); Little Common, near Bexhill (Rev. W. A. Shaw).

Subvar. *picta*, Jenner.—Occurs not uncommonly near Rye (J. H. A. Jenner).

Var. *lutescens*, Moquin-Tandon.—Winchelsea (specimens in the Rufford collection, Hastings Museum); Downs above Heyshott (E. W. S.).

Monst. *sinistrorum*. Near Stoughton (Rev. W. A. Shaw).

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

A Strange Nesting Association of the Squirrel and the Sparrow-Hawk.—Whilst rambling with a friend in June last through the wooded valleys of Gyffylliog, in Denbighshire, we found a Sparrow-Hawk's nest in a large alder tree at the foot of Foel Uchaf. On climbing to the nest, which contained four young and one egg just upon hatching, I flushed a Squirrel from its drey, which was situated immediately under the Hawk's nest. The Sparrow-Hawks had evidently used the Squirrel's drey as a foundation for their nest, and the two nests were practically what might be termed a two-storey domicile. It was evident from the foulness of the Squirrel's portion that the latter had probably been in occupation during the whole of the time of the incubation period of the Hawk, which was sitting within but a few inches above.—J. STEELE ELLIOTT.

AVES.

Increase of Little Grebes (*Podiceps fluviatilis*) Nesting in Bedfordshire.—Thirty years ago the Little Grebe continued to nest not uncommonly on all the larger lakes, and on many of the smaller pools, ballast-holes, and other water-pits about this county, as also, several pairs at least, along the River Ivel. About 1890 and for several years thence I made frequent visits to all the previous known nesting haunts, and all other likely waters, but with perhaps the one exception of Battlesden Lake they had already, or within a few years, ceased to breed anywhere in the county. It was not until 1909 that I first noticed them again in the nesting season, at Southill, one of their former favourite breeding haunts, and one over which I had kept very careful observation. Four pairs were seen on April 10th, and were calling freely, and no doubt eventually nested, but I was unable to follow up further observations that year. The year following I found several nests with eggs at this lake. From that date they seem to have been on the increase generally throughout the county, and now practically nest once again in all their former

haunts; and there are indications that they will become still more common. Until the present year I never knew of them nesting on the River Ouse, although, as already stated, they have been known to have nested on its tributary, the River Ivel; and in 1913 I found them also on the River Lea. In June last I found a pair nesting at Great Barford, and also another pair at Willington, and I have little doubt they will also be found in other localities along that river.—
J. STEELE ELLIOTT.

On the Laying of the Cuckoo (*Cuculus canorus*).—Two consecutive week-ends I spent on the River Ouse and its tributary the Ivel, in Bedfordshire, working upon the distribution of the Reed-Warbler. Finding two of their nests containing eggs of the Cuckoo, without a doubt laid by the same bird, I kept a careful look-out for any additional nests that might also be used by this same Cuckoo. Over sixty nests of Reed-Warbler in all were found on a stretch of six and a half miles of the Ouse, and a few other nests along the River Ivel, within a mile of the junction of the two rivers. The completed clutches of the Reed-Warbler varied from three to five eggs. Of these nests, eight had been selected by a Cuckoo, and five of them contained eggs laid by this one bird, to which the following particulars refer:—

June 5th.—River Ouse, Blunham. Nest in reed-bed alongside river. Eggs, one Cuckoo with two Reed-Warbler. Incubation about eight days.

5th.—River Ouse, Blunham. Nest in reed-bed alongside river, fifty yards' distance. Eggs, one Cuckoo with three Reed-Warbler. Incubation about three days.

12th.—River Ouse, Great Barford. Nest in reed-bed on an island, one mile distant up stream. Eggs, one Cuckoo with one Reed-Warbler. Incubation about seven days.

11th.—Near River Ivel, Tempsford. Nest in osier-bed and nine feet high, one mile distant east. Eggs one Cuckoo with three Reed-Warbler. Incubation about three days.

12th.—River Ouse, Blunham. Nest in reeds alongside river, half-mile distant up stream. Eggs, one Cuckoo with three Reed-Warbler. Eggs fresh.

The distances are taken from the first nest found. The other three nests found containing eggs of the Cuckoo were all at a greater distance away than any in the above area. In stating to what extent each clutch had been incubated, I had not previously considered the space of time that would have elapsed between each

laying, and if my conclusions are about correct, the eggs would have been laid on May 28th, June 2nd, 5th, 8th, and 12th respectively, and this points to the probability that an egg was actually laid every third day. I did not visit this locality again after June 12th, so I cannot say if any additional eggs of this clutch could have been found. The number of eggs of the foster-parent taken by the Cuckoo from these nests I am unable to state, but from the particulars already given, at least two appear to have been extracted from several of the nests.—J. STEELE ELLIOTT.

Late Stay of Fieldfares in North of Ireland.—I was greatly interested in Mr. Wilson's note in your issue for June, stating that a flock of Fieldfares were seen by him near Aberdeen on May 13th, which were much later than the flock I observed near Lurgan, which were seen on April 28th, although this is, I think, an unusually late date for them to be so far south.—W. H. WORKMAN, M.B.O.U. (Belfast).

Some Migration and other Notes for June.—We had to wait until June 15th before we saw a Wheatear, when we met with two males at Bridgend, Kildrummy. We have not seen any more of them. On the same date we saw about twenty Long-tailed Tits at Glenlogie. This is the second season I have seen them here. There have undoubtedly been some specimens of the White Wagtail during June here. Saw a Whinchat on moor ridge near Kildrummy policies on June 30th; it was a male and seemed to have a mate and to be breeding. I have noted two birds on July 1st, which I believe are Bramblings. At Battle Hillock I heard the unusual call of a male here for a female. The former was pretty tame, and flitted about upon a bush of broom, hopping along a branch in search of insects, in a way I never saw Chaffinches do. He next made an appearance upon gooseberry bushes in the garden, picking up caterpillars. Whatever be the cause, there is a great crop of the latter, giving much trouble. Have not as yet heard a Corncrake. Warblers seem rather quiet as regards song.—W. WILSON (Aberdeen).

Sparrow Robbing Starling.—On Whit-Monday I was watching a pair of Starlings hunting on a very small grass-plot in Ridgmount Street, W.C.; the cock had got a bill full of what appeared to be worms (which one often sees Starlings get on London lawns) when a Sparrow made a dart and snatched his booty from him. He then started chewing it but would not allow a very close approach, going off into some shrubs; the Starling went on hunting, without showing

resentment. If the objects seized really were Earthworms (as I believe), it is curious that a Sparrow should steal what one never sees it catch for itself; but American naturalists accuse the Sparrow of watching their "Robin" (*Turdus migratorius*) hunting worms, and then appropriating his prey just as this Sparrow did with the Starling.—F. FINN.

Quadruple Duck-hybrids at Kew.—This year there have been bred at Kew a brood of duck-hybrids of quadruple descent. The mother was a hybrid between a Chilian Wigeon (*Mareca sibilatrix*) and a duck which was itself a hybrid between the African Yellow-billed Duck (*Anas undulata*) and the Madagascan Meller's Duck (*A. melleri*); the father was a Chilian Teal (*Nettion flavirostre*). The birds thus bred are unlike any of the four species concerned in their origin; they were as large as their mother, and of a light brown colour, with the back much darker, and a sooty-black cap contrasting with the whitish cheeks and fore neck; in two the brown colour is reddish and uniform; in the other three it is more of a clay colour and slightly mottled, and the light edges to the back-feathers are more clearly defined. The inner secondaries, next to the "tertials," are pale slate-grey, as in the Red-crested Pochard (*Netta rufina*); the speculum, in the only one in which I could see it, was slaty-black with a white edge.—F. FINN.

C R U S T A C E A.

Abnormality in Edible Crab.—On June 18th I received a female Crab of about 2 lb. weight which showed only one genital orifice, on the right side. This was in the usual position and of the normal size, and there was no sign whatever of the corresponding one of the left side.*—F. H. BROOKS.

I N S E C T A.

***Vanessa antiopa* actually in Camberwell District.**—In the summer of 1873, when returning to my father's house—East Dulwich House, on East Dulwich Green—I found a Camberwell Beauty Butterfly, which I still have in my possession, in a Spider's web. It was very much alive but necessarily had become a very poor specimen through being in such a position. Of course it would have been of no use had it not been practically extinct in these islands. It has the *white* band round the wings, but it is a wreck.—WALTER MORGAN.

* We are much indebted to Mr. Brooks for having shown us this specimen.—ED.

NOTICES OF NEW BOOKS.

Annals of Tropical Medicine and Parasitology. Vol. ix. No. 1.
Liverpool: 1915. 7s. 6d. net.

IN the March number of this valuable publication, Dr. H. Bayon gives a long and interesting account of the experimental study of leprosy, a disease still, unfortunately, well known in hot countries, and lingering in several of those of Europe. "However," says this author, "the ruthless individual and, in some cases, collective segregation in the thirteenth and fourteenth centuries, aided, no doubt, by the improving hygienic conditions of all classes, succeeded in bringing about a practically complete extinction of leprosy in Middle Europe and Great Britain. In addition to this, various plague epidemics also helped in sweeping to an early grave, in a somewhat selective fashion, the vagrant and pauper lepers sooner and quicker than individuals belonging to better situated classes." It is considered that the communicability of leprosy has been fully established, and that the disease can be transferred experimentally to animals, though not readily. The spontaneous disease of rat leprosy shows much resemblance to the human disorder, and may yet be found to be etiologically related to it. Observations on the metabolism of white men living in the Tropics are contributed by Mr. W. J. Young, who in this first paper deals with the protein metabolism, and finds that the results, so far as they go, exhibit no marked variations from the averages obtained in temperate climates. Papers of more definitely zoological character are those on the species of mammalian lung-flukes of the genus *Paragonimus*, infesting man as well as other mammalia, by Messrs. H. B. Ward and E. F. Hirsch, and on new species of Tabanid Flies from Africa, by Mr. H. F. Carter. The papers are well illustrated by plates.

Brazil. By J. C. OAKENFULL. 1913 & 1914. 7s. 6d.

Two editions of this most useful and comprehensive publication are to hand, but in the department which concerns us there is no alteration; it would be well in fact if there had been a little in the zoological section, since there are some errors in the naming, &c. For instance, the Emu is credited to Brazil,

whereas this is simply the Portuguese name of the Rhea, also, and in this case correctly mentioned; and the celebrated plumes of the Egret or "garça" are said to be taken from the head of the male, whereas they are found in both sexes, and only occur on the head as well as the back in the smaller species (*Leucophoyx candidissima*), the large and widely-distributed White Egret (*Herodias*) having them on the back only. However, the two chapters on the fauna form interesting and useful reading, as also do the remarks on live stock. It is satisfactory to hear that the "Zebus" or humped Oriental cattle have been successfully introduced into a climate so suitable for them, and very interesting as well that the purely red Devon among our own breeds puts on more weight than the Durham or Hereford Ox. Among poultry, the Leghorn and Plymouth Rock are mentioned as thriving well, and it may be more than a coincidence that both these are yellow-legged breeds. The latter has a good name in this country for resisting cold and wet, and so has the Romney Marsh Sheep, another home breed which is well suited, it appears, to tropical conditions, so that special breeds of domestic animals, as well as species of wild ones, like the common Rat and Rock-Pigeon, may at times exhibit hardiness in face of opposite climatic conditions. The Goat is noticed as thriving, as in Europe, where other beasts would starve.

The Austral Avian Record. Edited by GREGORY M. MATHEWS.
Vol. ii. No. 7. London: Witherby & Co. 1915. 1s. 6d.

THIS publication, which is, in the present instance, written as well as edited by Mr. Mathews, is "devoted primarily to the study of the Australian Avifauna"; the department of that study, with which it is especially concerned, appears to be the determination of names and the description of new subspecies, so that it is not necessary to do more than draw attention to its existence in a periodical which concerns itself so little with such subjects as does the 'Zoologist.'

Report of the Punjab Department of Fisheries. Lahore. 1914. 9d.

THIS first and annual report of the Fishery Department in the Punjab has some valuable information on the subject of fish-culture in that part of India. Fish-culture in that country labours under many difficulties; poaching is rampant, and

besides the natural enemies we are used to here in the shape of Cormorants, Kingfishers and others (all far more numerous than in Britain), there are Crocodiles to be reckoned with! It is satisfactory to know, however, that the skins of these repulsive reptiles have a definite commercial value, the North-west Tannery Company having, it seems, issued a pamphlet on the skinning and packing process, and being willing to pay the equivalent of 1s. 2d. and 8d. per running foot for belly and tail pieces respectively.

Report on the Trout-cultural Operations in the Punjab, &c. By G. C. L. HOWELL. 4d.

THIS report, which covers the period from October, 1912, to the end of March, 1914, deals with the culture of introduced Trout in the Punjab and Native States under its control—Kulu, Simla Hills, Chamba, and Kangra. All India is entirely outside the range of the Salmonoids, their place in the Himalayan streams being taken by such fish as the “tasteless Mountain Barbel (*Oreinus sinuatus*).” There is thus a large range suitable to Trout and entirely open to them, and as Mr. Howell says, “To fill waters, which contain no fish worth eating, with the best of all freshwater fishes, can at least do no harm to anybody, while no conceivable circumstances can destroy the capitalized value of a good head of Trout in this or any other country.” It is therefore gratifying to know that Brown Trout, already introduced into Kashmir, from which the ova have been obtained for these experiments, promise to do well in the localities dealt with, and that Rainbow Trout, which are suitable for warmer waters, are being experimented with.

Hand-list of the Birds of Borneo. By J. C. MOULTON, B.Sc., M.B.O.U. From Straits Branch Royal Asiatic Society's 'Journal,' December, 1914.

MR. MOULTON is the Curator of the Sarawak Museum, and has here given us an up-to-date hand-list of the rich bird fauna of Borneo, which will be of much use to ornithologists. Subspecies are distinguished by italics, and placed after the name of the describer of the typical form of the species, the subspecies describer's coming last, thus:—“*Argusianus argus*, Linn., *grayi*, Elliott. The Bornean Argus Pheasant.” This is a good

practical way of dealing with the subspecies problem, as far as clearness goes, though it might be pointed out that when we have to use five words as the name of a given form, we are getting near the old-fashioned plan of a brief description of the species, to be used as its name, without its advantages of intelligibility. Moreover, although, as in the case of the bird quoted, the reduction of a form to subspecific rank is often an advantage both from the practical and scientific point of view, there is a tendency to overdue lumping, as when Mr. Moulton suggests that the largest form of the well-known Hill- or Talking-Mynahs (*Eulabes javanensis*) is probably a subspecies of the smallest or South Indian form (*E. religiosa*); the birds in this case being quite as different as the Carrion-Crow and Raven. There is an interesting disquisition in the Introduction on the evolution of nomenclature, but, although we fully recognize the utility of such lists as the present, one cannot understand why naturalists in the Tropics should worry about closet subjects at all, and we have full sympathy with our author's plan of relegating all proposed alteration of names to his footnotes.

Junior Botany. University Tutorial Press, Ltd. London, 1915.

THE study of field zoology is intimately connected with botany—indeed, we understand that one of our best known field botanists in this country commenced his Nature studies as an entomologist—so that, although we do not desire botanical books for review in the 'Zoologist,' it may be pointed out that the present manual is clearly written and well adapted for laying the foundations for botanical knowledge. Stress is particularly laid on experiments, which are far too much neglected by zoological students. The only direct references to animals in the book are naturally the descriptions of plant-devices for fertilization and seed-dispersal by the aid of animals.

The Auk. New series, vol. xxxii. Nos. 1, 2. Cambridge, Mass. U.S.A. 1915. 3 dols. yearly.

THERE is much good matter in the first two numbers of this Journal of the American Ornithologists' Union that have appeared this year, but some that is rather depressing reading. We are told by Mr. Henry K. Coale in the January number of the

threatened extinction of the Trumpeter Swan (*Olor buccinator*),* the largest of the known Swans, as it slightly exceeds the Mute Swan in size, though in all other respects it closely resembles the Whooper, save for having the bill and face all black; and Dr. R. W. Shufeldt gives some notes on the last specimen of the formerly super-abundant Passenger Pigeon (*Ectopistes migratorius*) known to have existed, a specimen which was bred in captivity in the Cincinnati Zoo and died there at the age of about twenty-nine years. What happens to American birds when they get rare is well illustrated by Mr. Frederic H. Kennard's paper "On the Trail of the Ivory-bill," in which he tells us hardly anything about this splendid Woodpecker, now apparently confined to Southern Florida, except that he shot the only one he saw.

Such cynical destructiveness on the part of people who are supposed to be naturalists makes the execution wrought by those who kill for economic reasons pardonable by comparison; there is enough of this in all conscience in the valuable records of the past history of the Wild Turkey, diligently collected by Mr. Albert Hozen Wright; these are classified according to political divisions and arranged in chronological order, and occupy considerable space in both numbers to hand. It is noteworthy that the older writers quoted, speaking of the days of early settlement, when white men were scarce and Turkeys common, constantly mention forty pounds as the weight of adult males; it would thus seem that the northern race of Wild Turkey in its palmy days grew quite as large as the less known Mexican wild form from which our tame birds were originally derived, though this has been credited with larger size. Several authors also refer to the Indian stuffs of a plush-like character made by weaving Turkey-feathers with twine. Mr. John C. Phillips discusses his attempts to discover what possible effects acclimatization has had on the Common Sparrow in America; but this philosophical enquiry has proved difficult to prosecute, as collectors, both professional and amateur, would not or could not bother about Sparrows. What data were to hand led to the conclusion that the enquiry would be better called "A study of the stability of a species under wide-ranging climatic and geographical conditions."

* *Cygnus buccinator* of the 'British Museum Catalogue of Birds,' vol. xxvii.

In the April number Mr. Frederic H. Kennard has a paper on the "Okaloacoochee Slough in Florida," embodying notes on the Burrowing Owl, with figures of its burrow—he says that the Owls "never seemed to sleep, day or night" (we have observed that most Owls in the Zoo, except Barn-Owls, seem usually awake); on the Roseate Spoonbill, rather absurdly called locally "Pink Curlew," and other waders, and a curious observation on the Swallow-tailed Kite, a specimen of which continued to fly over his head after its wing had been broken at the pinion joint by a shot.* Why he should have been shooting a bird like this, perfectly well known, absolutely harmless, and, as he remarks, of exceeding beauty, at the beginning of its breeding-season, he does not say. Dr. Winsor U. Taylor writes on the simultaneous action of birds, and suggests as an explanation that telepathic power, more greatly developed in them than in man, is responsible for their concerted actions. Among the shorter notes in this number is found a well-known indictment against the Cape May Warbler (*Dendroica tigrina*) as a destructive consumer of grape-juice in Pennsylvania; it is estimated that all unbagged grapes were ruined by this "little striped yellow bird" in the autumn of 1913, the loss amounting to many tons, worth several hundred dollars.

British Birds. Vol. viii. Nos. 8-12. Vol. ix. No. 1.
London: Witherby & Co. 1915. Monthly. 1s. net.

THE January number of 'British Birds' does not begin a new volume, the eighth volume ending in the May number, while June inaugurates volume nine. There are some excellent papers in these half-dozen numbers, including several by Miss M. D. Haviland, who deals with the breeding-habits of the Curlew-Sandpiper, Little Stint, and Grey Phalarope, as observed by her recently in Siberia. The notes are accompanied by photos, some of them very good. Mr. J. H. Owen has some good notes in the January number on the food and habits of the Sparrow-Hawk; he enumerates as birds he has known killed,

* There is, or was recently, at St. James's Park, a Black-headed Gull which flew freely about, although minus half a wing through pinioning, and a splendid pair of Common Herons at Kew had learnt to fly though pinioned, and ultimately disappeared.

besides the small common kinds, Pheasants, Wood-Pigeons, Turtle-Doves, Partridges, Great and Lesser Spotted Wood-peckers, and Cuckoos ; he has seen a Teal chased very hard, and a young Moorhen picked off a pool ; Blue Tits were brought to a nest he watched "more often than might be expected." Mr. H. W. Robinson, in the February number, records the results of ringing Black-headed Gulls, and a very gratifying ringing record is that by Mr. J. S. Allison, in the April number, of his having rung, fed and released a Little Gull—no doubt the first, as he suggests, to be rung under the scheme—which had been caught in a Plover-net near Louth, Lincolnshire. On the same page Mr. Clifford Borrer records seeing a Glaucous Gull in St. James's Park among Herring-Gulls. As he speaks of its "milky-white" plumage, it could surely not have been adult as he suggests, the stage in which the plumage is creamy-white all over being intermediate between the mottled young plumage and the grey-backed white adult dress, in which the most obvious difference from the Herring-Gull (besides the size) is the absence of black on the primaries. The disappearance of some Bearded Tits introduced from Holland, at Hornsea Mere, is noted from the 'Naturalist,' to the satisfaction of the editors, who deprecate "this interference with Nature." They have, however, nothing to say against the destruction of six Dusky Thrushes (*Turdus fuscatus*) recorded in April also, five of which were shot at the same spot, at Hollington, in Sussex, and included both sexes, between January and March ; evidently they think that, though it is interfering with Nature artificially to extend the range of a species, there is no interference about killing down the pioneers, when extension of range is taking place naturally ! There are, of course, in these numbers plenty of other records of the killing of birds found outside their usual range, but none so far new to the country. A remarkable note is that of Mr. H. E. Forrest in the January number of the fowl-like tameness of a Redwing in Shropshire, which for a fortnight had accompanied a man employed in spreading sods, to feed on small life exposed. In the March number Mr. O. G. Pike has some notes and fine photographs of the Fulmar at home. In the June number Mr. A. H. Macpherson records a Mistle-Thrush singing on the wing, and Mr. E. H. Wendy has a similar record

for both this species and the Blackbird ; we ourselves once heard a Blackbird do this in the Zoo grounds, and the curious thing was that it was carrying a worm at the time. Another remarkable Thrush-record, in the March number, quoted from the 'Scottish Naturalist,' is that of a Blackbird and a Song-Thrush feeding on daisy-flowers, in the latter case the subject being a young bird thus fed by its parent. In the June number Mr. R. M. Barrington lists the occurrences of the Common and Black Redstarts at light-stations in Ireland ; of thirty-five Common and eighty Black, twenty-six of the former and thirty-two of the latter were killed striking, the rest being shot, caught, or found dead. The records are interesting, but here again we cannot help feeling colonization is being checked. A nine-page paper opening this number, and thus the new volume, by the authors of the 'Hand-List of British Birds' (Messrs. Hartert, Jourdain, Ticehurst and Witherby), discloses the fact that after the dismissal of many well-known names in this publication and the introduction of others, in quite a number of cases, further research has shown that the familiar name has got to be restored. Some particular cases are astonishing : the American Bittern is restored to its previous rank as a species, having been degraded to a subspecies of our Bittern in the 'Hand-List,' though it differs not only in colour and pattern of plumage but in note. The Golden-eye Ducks, too, are allowed a genus of their own again, after being lumped with the Pochards in the List, though their real affinities are with the Mergansers. Species and subspecies splitting is bad enough, but lumping can evidently be equally so. In this supplementary paper we are told we must not call the Common Flamingo *Phoenicopterus antiquorum* any longer, but *Phoenicop-terus ruber antiquorum*, because it is only a subspecies of the red American Flamingo, differing "only in degree of coloration." This is not so ; both species may be seen at the Zoo alive, and noted to differ in height and proportions (the red bird being shorter and stouter), in colour of beak, and in the shade of the red where both have it, on the wing-coverts. Evidently a good deal of ignorance is needed to manipulate British bird-names in the method approved in Germany and too often elsewhere.

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Contributors will kindly note that the Editor of the 'ZOOLOGIST' is MR. FRANK FINN, 23, CHALCOT CRESCENT, PRIMROSE HILL, N.W. All Articles and Communications intended for publication, and Books and Pamphlets for review, should be addressed to the Editor; or to the 'Zoologist,' c/o West, Newman & Co., 54, Hatton Garden, London.

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THE ZOOLOGIST

No. 890.—*August 15th, 1915.*

THE RELATION OF THE OYSTERCATCHER TO ITS NATURAL ENVIRONMENT.

By J. M. DEWAR, M.D.

I.—INTRODUCTION.

THE effective relation of an animal to its environment largely depends upon characters that are structural, physiological, and psychological. The more specialized these characters are, the more rigidly limited is the nature of the environment to which the animal is able to respond. The Oystercatcher is structurally specialized for a particular mode of feeding. Physiologically, it appears to need large quantities of bulky, soft food, such as shell-fish in winter, large earthworms and larvæ inland in summer, as it does not remain long in localities where these are not available. Psychologically, the individual behaviour is mostly stereotyped, and there is little evidence, short of the experimental, of any capacity for adjustment to environments which do not fulfil the special conditions of existence. Specialization secures the Oystercatcher from active competition with neighbouring forms, especially for food, but it necessarily results in the distribution of the species being discontinuous and dependent upon the simultaneous recurrence of complex and little variable environmental conditions.

1. *Areas under Observation and Method of Inquiry.*—The present communication reports the results of enquiries made on the south shore of the Firth of Forth during the winters 1906–1914 inclusive; on Loch Tummel, the lower portion of the River Tummel,

the River Garry below the village of Blair and in Glen Fender, all of which are in North Perthshire, during the summers 1909 to 1914 inclusive. The former represent the winter environment; the latter a summer environment of the Oystercatcher, no data being here included from the coastal breeding stations. Observations of a less continuous character were made in other localities as a means of control. No attempt was made to work out the local distribution in either the summer or the winter area, or to obtain experimental control of any environmental factors.*

On the Firth of Forth localities were noted where Oystercatchers were found to occur. By repeated observations it was ascertained whether the places were in permanent winter occupation or not. In the former case, the number of occupants was periodically estimated, and the environmental conditions were, as far as possible, discovered. *Mytilus edulis* was accepted as the chief food supply of the Oystercatcher. Where the birds were occasional visitors to important stations of *Mytilus*, or did not occur at all, the stations were regarded as potential Oystercatcher stations, and their conditions found. Two chief types of habitats were recognized on the sea-beach. These were compared intensively, in order to determine which might be the more favourable to the Oystercatcher.

In the summer environment three habitats were separated. The number of pairs per linear measure of loch, river, and hill-stream was used to determine the most favourable habitat. The conditions of all likely or occupied breeding-stations under observation were noted and compared to find those common to all the stations, those present only in the more favourable stations, and those wanting at potential stations. The results derived from the individual stations were then aggregated for the several habitats, and the conditions of the most suitable habitat discovered.

II.—THE WINTER ENVIRONMENT.

1. *General Considerations.*—The northern shore of the Firth of Forth, below the Forth Bridge, generally descends steeply into

* Valuable information on the areas under observation was obtained from the 'Memoirs of the Geological Survey of Scotland,' Nos. 32, 33, and 55; Appendix III. to the 'Weekly Weather Report' for 1906; the Admiralty Charts and Manual,

the sea, and the breadth of the littoral zone is small. The abruptness of the gradient is due to the passage of the deep north channel (the old river-bed) close by the northern shore. The exposure eastwards of Kinghorn to easterly and south-easterly storms is severe, and the beach is mostly rocky and sea-worn. The southern shore, on the other hand, descends gently into the bed of a shallow sea, and the depth of the littoral zone is, in most places, considerable. The greater part of the coastline is sheltered from storms. To the east of Weak Law, however, the shore falls more rapidly towards the sea; the littoral zone becomes narrower, and the rocks more and more sea-worn, as the exposure to the effect of storms and the depth of the adjacent waters increase. The distribution of the Oystercatchers is evidently affected by the general features of the coastline, for they are relatively scarce along the northern shore, plentiful on the south coast westward of Weak Law, and less numerous eastward on the open coast.

Geologically, the south coast shows an ascending series of rocks from east to west. Beginning in the Old Red Sandstone period, a change occurs in the vicinity of Weak Law to the Carboniferous series, which persists to and beyond the western end of the area. The sedimentary rocks have little importance in the present connection. The abundance of durable volcanic lavas and intrusions has a considerable indirect effect on the Oystercatcher population; the non-columnar form of analcrite basalt being especially favourable to the formation of *Mytilus* settlements.

The average temperature for the whole year at Leith (5.5 metres above M. S. L.) is $8.83^\circ \pm 3.72^\circ$ C. The monthly means are $6.16^\circ \pm 3.00^\circ$ in November, $4.11^\circ \pm 2.83^\circ$ in December, and $3.89^\circ \pm 2.95^\circ$ in January (1871-1905).

The mean rainfall at Leith is 0.60 metre; the number of wet days, 179 (1871-1905).

The prevailing winds are westerly.

The ordinary spring tide rises 3.7 metres at Dunbar, 4.6 metres at Prestonpans, 5 metres at Leith, and 5.8 metres at the Forth Bridge. The increase in rise of tide from east to west causes the foreshore to be deeper for equal gradients in the higher reaches of the estuary. Full seas occur in late autumn

and early spring, when the available feeding-grounds are greatly enlarged at low water. The vertical range of the low-water line is much greater than that of the high-water line, so that the advantage gained in the lower zones of the beach during spring tides is more than lost during neaps. For the same reason, the diminution of tidal range in passing from spring to neap tides is not directly proportional to the loss in height of the tide, but diminishes at a greater rate. The tidal range during neap tides is, therefore, a factor of importance in controlling the numbers of a settlement. The area under observation was too small to allow of a comparative study of the effects of locally different tidal ranges. The occurrence of the fortnightly succession of highest tides between the hours of one and five has, in the day-time, an important bearing on the welfare of the Oystercatcher in relation to human activities.

All three divisions of a sea-beach recognized by Pearse in Massachusetts * occur in irregular sequence on the south side of the Forth. They are the rock-beach, sand-beach, and the mud-flat. The first and last are habitats of *Mytilus*; the second is of minor importance to the economy of the Oystercatcher. As the division was found to be a natural one, the rock-beach and the mud-flat will be taken, for comparison, as the two locally typical habitats of the Oystercatcher. Along the sixty odd kilometres of coastline from the Forth Bridge to Belhaven, Dunbar, there were found seven permanent winter settlements of the Oystercatcher. Of these, one is a purely mud-flat station, two are mud-flat, rock-beach stations, while the remaining four are confined to rock-beaches only. In addition, two large *Mytilus* stations, not permanently occupied by Oystercatchers, were under observation. In the next section an account is given of the general features of the stations examined, in order to afford some idea of the nature of the ground in this locality.

2. *Mud-flat Habitat*.—Estuary of the East Lothian Tyne. The river flows into a small estuary locked from the North Sea by a long sandbar. The substratum consists of sand in the outer and marginal parts of the estuary, and of a fairly firm mud in the centre of the area, through which the channel flows. Weed is not common. There is a plentiful supply of Mussels of

* 'Rev. Knowledge,' 1915, p. 59 (no reference given).

good size on the mud. The central area slopes more steeply downwards where it borders the channel so that, when the tide is out, the birds can feed without being readily seen from the land. The feeding area is more than 150 metres from the grass. The central portion of the sandbar does not cover at high water, when it is used as a refuge. There is a moderate stock of Oystercatchers.

3. *Rock-beach, Mud-flat Habitat.*—A. *Aberlady Station.* Aberlady Bay is a large sandy and muddy flat, intersected by the channel of the Peffer Burn. The bay may be divided into three transverse zones. The highest zone is rarely visited by Oystercatchers. The middle zone, west of the channel, is a mud-flat. The mud is tenacious and does not shift readily. The greater part of the area is covered with Mussels of a good size, and is more than 150 metres from the nearest danger point. Eastward of the channel the conditions are, at first, similar to those of the western part of the middle zone, but they soon change to a sand-beach, which extends to the eastern high-water mark. The lower zone is composed mainly of sand-flats, which become extensive as the bay widens towards its outlet. In the middle zone, with the exception of the steep borders of the channel, the substratum lies mostly above mean-water level. In Gosford Bay is a large smoothly contoured area of volcanic rock. *Mytilus* is abundant here and of fair size. The mud in the lower part of the bay is apt to shift and bury the lower lying Mussels. East of these rocks a sandy bay is a factor of some importance. The rocks at the east and west ends of Gosford Bay are loaded with *Fucus*. At the east end of Longniddry Bay is a stretch of low-lying volcanic rocks, well provided with Mussels. These rocks, though lying rather near the high-water mark, are covered early by the incoming tide. The volcanic rocks east of Gullane Point have considerable supplies of Mussels. These rocks alternate with sand-beaches. They lie close in to the shore generally, and through their conformation are easily approached. One part extends far out into the sea, but the non-tidal portion runs nearly as far, and is well adapted for stalking. The area is visited irregularly by Oystercatchers. The refuge for this station is nearly five kilometres distant (Eyebroughty). The resident stock is, perhaps, the largest in the Forth. The birds

have a special tidal range of movement. Beginning at low water at the western-most feeding-place, they move eastward by stages, according to the tide, each of the three main feeding-places being adjusted to a certain state of the tide, and end towards high water at the eastern-most part of their range—on the refuge of Eyebroughty. The sequence is reversed on the ebb.

B. *Drum Flats Station.* The two previous examples of the mud-flat habitat are enclosed in small estuaries, debouching in the one case into the North Sea, in the other, into the estuary of the Forth. The Drum Flats, now to be described, border the Forth itself, and form on the southern shore the lowermost part of the continuous mud-beaches of the upper estuary. The mud is light and shifting in places, more tenacious in others. Weed is luxuriant. Bordering the channel of the River Almond the mud is firmer, and large areas afford an abundant and good supply of Mussels. The feeding area lies more than 150 metres from the land. A large stock is resident in winter. A range of tidal volcanic rocks lying to the west of Granton Harbour and well off shore is covered with Mussels in the absence of weed, and is much visited by the settlement. Cramond Island, lying at the mouth of the Almond Channel and close to the principal feeding area, is inhabited. The Oystercatchers do not resort to it. The refuge is on the Islet of Inchmickrey, lying on the middle bank of the Firth of Forth. The exposure is not severe.

4. *Rock-beach Habitat.*—Of the four stations of rock-beach habitat coming under observation, one (Eyebroughty) will be described in some detail, and only the factors by which the others differ from the Eyebroughty station will be mentioned. In the Eyebroughty station a long tidal reef, lying to the west of Eyebroughty, and about 450 metres from the mainland, provides quantities of *Mytilus*, for the most part of small size. The settlement feeds here a good deal, but the foothold is only moderately good, and in storms the reef is wave-swept. Near Cheese Bay there are two large bosses of volcanic rock lying well off the land. They are crowded with *Mytilus* of small size, and are visited daily. At the east end of Redhouse Bay there is a flat, low-lying rock forming a horn to the bay. The outer part carries a moderate stock of small Mussels. Part of the

ground is under 150 metres from cover. Here the birds are irregular visitors, mostly in the mornings and in bad weather, if tides are suitable. West of Weak Law is a bed of shale abundantly supplied with shell-fish of various kinds and suitable size. It lies more than 150 metres from cover. The rocks at Weak Law are poor in *Mytilus*, but rather rich in *Modiolus* and *Patella*. They run well out to sea. Approach, however, is easy owing to the lie and nature of the rocks. They are seldom visited. Further east lies a great mass of lava, portions of which are permanently cut off from the main mass by water. *Mytilus* is abundant but small. The birds visit these rocks frequently, and are here difficult to approach. The western part of Fidra Brig (lava) provides quantities of *Mytilus* and *Modiolus*. The rock is hummocky, and the feeding area is not too far from the mainland. The birds visit occasionally and can be stalked with comparative ease. Eyebroughty Brig lies more than 360 metres from the mainland, opposite the central portion of the shore area. It is used as a refuge. The stock of birds is small.

The Seacliff settlement is small. The features are similar to those found at Eyebroughty, but the depth of foreshore is less, and there is a severe exposure to storms. In some places the *Mytilus* stations are within 150 metres of the grass. A long volcanic reef, dry at high water, lies well off shore, is used as a refuge, and probably also as a feeding-ground.

The Lamb station is peculiar in that the islet forms both the refuge and the principal feeding-ground. Supplies are also drawn from the Longskellies and from skerries off North Berwick. The exposure is fairly severe. The feeding-grounds are difficult of access. The stock is small.

The small Cuthill settlement lives in unusual surroundings. A low-lying, slabby rock centres a small bay of gravelly sand, and lies about 180 metres from the coast road. A small harbour, a tile-works, a coal-pit, and a number of miners' rows partially surround the locality, which is in itself rather difficult of access, and therefore not much disturbed. The rock has a good supply of *Mytilus*. A volcanic dyke, dry at high water, lies off shore, and is used as a refuge and a *Mytilus* feeding-ground.

Two large *Mytilus* stations of rock-beach habitat occur at

Redhouse and at Seafield. Neither has a resident stock of Oystercatchers, and visits are irregular, occurring mostly in the early morning. At the former station the rocks descend abruptly to a sand-beach, and have little breadth. The larger sizes of Mussels preponderate, but lie well within 150 metres of the grass. In the latter, the eastward rocks have a similar character. Towards the west the rock-beach is prolonged out to sea by a succession of more or less isolated reefs carrying plenty of Mussels. The foreshore here is much disturbed. Neither of these areas has a refuge within ordinary range.

III.—DISCUSSION OF THE WINTER ENVIRONMENT.

Summing up the conditions common to all the occupied stations of the rock-beach and mud-flat habitats on the south shore of the Firth of Forth, we have the following:—A body of seawater; *Mytilus* in sufficient quantity, of a suitable size, in accessible situations, and at or more than 150 metres from the nearest danger point; a place of refuge which can be resorted to for safety during the period of high water, and at other times when the feeding-grounds are disturbed.

Resort to a place of refuge at certain times is a local adjustment to human interference. In the early part of the winter, when disturbance is infrequent, the birds rarely leave Aberlady Bay during diurnal high water, and if they do, it is with manifest reluctance. At high water they collect at one part of the shore, which is a constant for the purpose, and takes the place of the refuge as the headquarters within the territory. As the winter advances, the birds are more liable to be driven from the high-water mark. They then proceed to the refuge. Later still, in the daytime they "anticipate" disturbance by not coming in to the high-water mark at all during spring tides, and proceed to the refuge one or two hours before the time of high water. But throughout the whole winter, during the diurnal high water of neap tides, and the nocturnal high water of all tides, the birds remain at the headquarters in the bay. In the former instance, the low gradient of the beach enables the birds to remain on the high-water line beyond the range of gunfire. In little disturbed localities, permanently occupied winter stations occur which have no special refuges. The Oystercatchers which feed

on the Mussel-bank at the mouth of the River Awe, or the Mussel-scalps on lonely parts of the coast of Northumberland, have no distinctive refuge. They pass the time of diurnal high water on a constant part of the high-water mark. When disturbed, they proceed to little-frequented fields in the vicinity.

Oystercatchers show a decided preference for Mussels about 3.5 cm. in length. Why, has not been determined. Probably Mussels ranging closely about this size provide food in due proportion to the amount of labour required to get it. When the Mussels are larger, too much energy is needed to open them; when they are smaller, too many have to be opened, and the more fragile shell is apt to be crushed into the body of the mollusc. In this condition they are commonly refused.

The situation of the feeding-ground at or more than 150 metres from the nearest danger point is also an adjustment, probably local, to human intervention. In the Firth of Forth large areas of Mussel-scalp, providing an abundance of food, lie too near the shore line owing to steepness of the gradient. These areas are seldom visited. When they occur near to or within a permanent winter station, they are visited only at night or in the early morning.

To most of the permanent stations in the Firth there are attached areas of wet sandy beach, generally lying close to the feeding-grounds. These areas are much used, especially after a spell of feeding, for the purpose of crowding together, preening and resting, and, in fine weather, for the sunning reaction. The presence of such an area is, however, not essential, for the condition is absent from the Lamb territory. The habit is not protective during the resting periods. The birds are very conspicuous while on the sand, whereas on the rocks or on mud, crowded with Mussels, they are often hard to distinguish. Crowding together appears to form an essential part of the habit. Owing to the irregularities of rocky areas and of mud-banks, dotted with clumps of Mussels, crowding can rarely be possible in these localities. A smooth expanse of sand is better adapted to the purpose. It is also possible the soft wet sand is a necessary condition of the response.

Along the Forth the Oystercatcher has few enemies, and even the depredations of man—the most important destructive

agent—have no apparent effect in the course of the season on the general mass of the birds. Comparative immunity is due to the wildness of the birds and to their extreme sensitiveness to the existence of potential dangers. Man, however, is himself an important condition of the environment. He has modified the local habits of the birds by leading to the establishment of refuges, and by limiting the number and size of the available feeding-grounds. The Peregrine is able to produce little more than a momentary commotion in the ranks of the Oystercatcher: no attack has been seen. The Sparrow-Hawk and the Kestrel are ignored. The Great Black-backed Gull is treated with some respect. The two species have not been seen very close together. No attack has come under observation. Throughout the winter the number of Oystercatchers in the area is not appreciably diminished, though there must always be the loss of a few.

The activities of the Oystercatcher are controlled in winter by the rhythm of the tides. The birds are slavish followers of the tideline. For about four hours during each period of high water the main supplies of food are inaccessible. As a consequence, the periods of rest and activity are determined by the tidal rhythm. There is also a rhythm of longer wave length dependent on the fortnightly oscillation of the tides. This rhythm is never manifest in early winter, but gradually appears in consequence of human interference. It shows itself by day, as a "reflex anticipation" of the greater height of the high water of spring tides. It is not due simply to the tide carrying the birds above the high-water mark of neap tides, for restlessness and the departure to the refuge occur long before the neap high-water mark is reached by the tide. The basis of the reaction is evidently complex.

It is doubtful if a true tidal habit, diurnal or bi-weekly, is ever established. No observations on this matter are possible on the shore. I have so far seen no sign of a tidal rhythm in the habits of the birds when they begin to move up the rivers where they breed. Diurnal rhythm is obscured in the winter environment of the Oystercatcher, the activities of the birds being regulated by the movement of the tides. Search for food continues after dark, and is evidently carried on much as in

daylight. The accumulation of excrement on the high-water mark of the night tide, when the latter reaches its highest point hours after darkness sets in, is sufficient evidence of night feeding, for the process of digestion and excretion in the Oystercatcher is extremely rapid. Darkness, however, has a restraining influence on nocturnal flight; for, whenever high water occurs in Aberlady Bay near the time of sunset, the birds, if disturbed, show unwillingness to fly to the refuge on Eyebroughty, and remain over the bay, prosecuting an aimless flight until the tide ebbs far enough to enable them to alight out of range. Further, by night the birds remain, so far as known, in the central parts of the feeding-grounds. They extend their feeding excursions to the more distant parts of their territory only in bright moonlight.

In winter the influence of variations in climatic conditions is mainly an indirect one, for the Oystercatcher is remarkably hardy, no extremes of temperature or humidity likely to occur in the Forth area seeming to have any harmful effect. Torrential rain inhibits all except compulsory movements, until the need of satisfying hunger becomes paramount. Really hard weather increases the food activities, at the same time suppressing all motor signs of the pleasure state. The appearance of the birds, however, never suggests a condition of "physiological misery." With the coming of the new year, moderately cold weather, if associated with bright sunshine, is favourable to early nuptial developments, while the mild weather of autumn brings out "autumnal genital activities."

Climatic control is exercised mainly over the available food supply. The Oystercatcher cannot open a Mussel when it is tightly closed, unless the byssal cleft can be reached, or the Mussel is small enough to be crushed. The former possibility rarely occurs; the latter seems to be dictated by necessity and not by preference. Extremes of temperature and moisture (bright sunshine, heavy rain, dry winds, hard frost) lead to an early and firm closure of the shell-valves of *Mytilus* soon after the Mussels emerge from the tide. The search for Mussels is then greatly restricted. The climatic aspect of the problem is important, for, so far from being a rare occurrence, weather conditions affect the food supply on almost every tide.

(To be continued.)

NOTES ON THE EGGS AND LARVÆ OF A SEA-BULLHEAD (*COTTUS BUBALIS*).

By H. N. MILLIGAN, F.Z.S.

A healthy female *Cottus bubalis* of about six inches in length, from Weymouth, was placed on January 23rd, 1915, in an aquarium at the Horniman Museum, where it lived until May 9th.

The Bullhead usually lay upon, or partly buried in, the shingle at the bottom of the aquarium, but at about 9.30 on the morning of January 28th I noticed that the fish was clinging by means of its spreading pectoral fins to the vertical rockwork at the back of the tank, and it remained there for several hours, certainly until 5 p.m. and possibly longer. Some time before 9.30 on the following day the fish moved away, and in a shallow depression amongst the rocks over which it had lain was a flattish mass of pale orange-coloured eggs. The mass, which was roughly oval in shape, was about two inches in length and one and a half inches in breadth. It was ascertained later that the number of eggs in the mass was nearly two thousand, and at its deepest part the mass was about twelve layers of eggs in thickness. The average size of the eggs was 1.5 mm.* The eggs adhered together at laying, but they became harder and more firmly attached as the days passed. Not more than a quarter of the eggs in the mass developed.

The day after laying, the Bullhead returned to the egg-mass, and remained on it for about two hours, but it was impossible

* J. T. Cunningham, "On Some Larval Stages of Fishes," "Journal Marine Biological Association," N. S. 2, 1891-2, p. 72, gives the diameter of the eggs examined by him as 1.7 mm. E. W. L. Holt, "On the Eggs and Larval and Post-larval Stages of Teleosteans," "Scientific Transactions of the Royal Dublin Society," vol. 5, ser. 2, 1893, p. 27, observes that he found the eggs larger in some clutches than in others, the largest being 1.88 mm. Fabre-Domergue & E. Biétrix, "Recherches Biologiques applicables à la Pisciculture Maritime," "Annales des Sci. Nat.," vol. 4, 1897, give the diameter of the egg as 1.5 to 1.6 mm. E. Ehrenbaum, "Eier und Larven von Fischen der Deutschen Bucht. 3. Fische mit festsitzenden Eiern," "Wissenschaftl. Meeresuntersuch. in Kiel," N. F., Band 11, 1910, p. 187, gives the size of the eggs as 1.51 to 1.76 mm.

to see whether she laid any more eggs.* Beyond this she showed no interest in the eggs, nor did she pay any attention when they were interfered with. It may be pointed out that no other Bullhead had been in the aquarium, and that no fresh sea-water had been introduced into the tank for some weeks. It would therefore seem that this female had been fertilized in the sea, from which it had been taken six days before the eggs were laid.

On the afternoon of February 17th (that is, on the twenty-first day after laying) the eggs were transferred to another tank, in order to guard against the danger of the coming larvæ being eaten by the several individuals of the Goby (*Gobius paganellus*) and the two individuals of the Prawn (*Palæmon serratus*) which lived in the same aquarium, though neither Gobies nor Prawns had touched the eggs. Two hours later the larval Bullheads began to break away from the egg-mass, and hatching went on at intervals during that day and the next. Hatching was possibly hastened by this removal, for according to Ehrenbaum the eggs are laid in March and April and hatched six to seven weeks later.† Less than a quarter of those which had arrived at a stage when they were able to escape actually hatched from the egg, so that out of nearly two thousand eggs only about a hundred larvæ were obtained. For several days before hatching, the larvæ could be seen making occasional sudden movements within their egg-envelopes, and their eyes, which were of a bright metallic blue or green colour by reflected daylight, or a bright copper colour by the light of the electric lamp above the aquarium, were very conspicuous. Each transparent larva, which was 4·5 mm. in length at hatching,‡ had a protuberant abdomen, long tail, and two large membranous semicircular pectoral fins.§ The larva could easily be detected in the water

* M'Intosh, "Remarks on the Eggs of British Marine Fishes," 'Nature,' vol. 34, p. 148, says that, so far as was known, deposition of the eggs is performed rapidly in the *Cotti*. † *Op. cit.* p. 187.

‡ The length of the larva at hatching is given by different authorities as follows:—Cunningham (*op. cit.* p. 72), 5·7 mm.; Holt (*op. cit.* p. 27), 5·71 mm.; Fabre-Domergue & Biétrix (*op. cit.* p. 168), 4·5 to 5·5 mm. Ehrenbaum (*op. cit.* p. 138), 5·5 to 5·8 mm.

§ Figures of the newly-hatched larva are given by Cunningham (*op. cit.* plate iv.), Holt (*op. cit.* plate v.), and Ehrenbaum (*op. cit.* plate iii.).

by its bright eyes and the saddle-shaped mass of black pigment in the abdomen.*

Immediately it had jerked itself free from the egg-mass, each larva began to swim vigorously in a vertical, or nearly vertical, position at, or close to, the surface of the water by rapid vibrations of its tail. None of the larvæ pursued a straight course through the water, their movements being exceedingly irregular. One of them, for example, went round and round in circles of about half an inch in diameter, at the same time revolving rapidly on its long axis. Several of them were to be seen moving round in such a way that their tails described small, while their heads described larger, circles. None of them moved tail foremost. After a few minutes of swimming a larva would cease to move its tail, and sink to the bottom to rest for two or three minutes, and then it would give a convulsive jerk and begin to swim again. These observations were made on the larvæ which were in an aquarium, containing nearly thirty gallons of well-aerated and constantly-moving sea-water, standing in a fairly dark spot. The behaviour of a dozen of the larvæ placed in a white enamelled bowl containing about a gallon of still sea-water in the direct light from a window was of a similar character. The larvæ in the larger tank seemed always to be fairly evenly distributed throughout the tank, and there was no tendency in the larvæ to congregate behind the glass front.†

At the beginning of the second day after hatching, the larvæ seemed able to keep a more even course through the water, and to swim with greater vigour. If the motions of its tail ceased, however, a larva would immediately turn head downwards and fall slowly to the bottom, where it would usually lie for a few minutes, its little eyes shining so brightly that it was not at all difficult to detect them amongst the shingle of the bottom. After several ineffectual attempts I was able to time one which swam obliquely upwards through an almost straight course of about fourteen inches immediately behind the glass front of the tank; it took fifty-four seconds to swim this distance, so that

* Cunningham (*op. cit.* p. 73) points out that the pigment is not in the skin but in the peritoneum over the region of the stomach and rectum.

† Fabre-Domergue & Biétrix (*op. cit.* pp. 174-9) describe the attraction of light on the larvæ of *Cottus bubalis*.

the larva must have travelled at the rate of about one inch in four seconds.

At the end of the fifth day after hatching the average length of the larvæ was 5·5 mm., and their ability to keep a straight course through the water was still more marked. There seemed also to be a decided tendency towards swimming in a horizontal position. The larvæ appeared, however, to be almost helpless, and when touched with the point of a pencil made at most a little jerk away from it. Repeated touches with the point of a pencil merely resulted in repeated horizontal jerks, and did not cause the larvæ to seek safety by diving deeper into the water; nor did agitation of the water by a pencil held close to any larva seem to alarm it.

On the sixth and seventh days the larvæ began to give indications of inability to swim vigorously, and to lie for longer and longer periods on the bottom. They now began to die off rapidly, the last one dying on February 26th, that is, on the ninth day after hatching began. Those placed in the bowl of still water did not live beyond the end of the second day.

During the night of February 20th-21st (*i. e.* on the twenty-fourth day after laying, and on the fourth day after hatching began) the Bullhead laid another, and smaller, mass of eggs. The number of eggs in this mass was not more than eight hundred, the great majority of which developed so far as to be ready for hatching, although only about thirty actually hatched out, the remainder dying at this stage. The egg-mass was transferred to a fresh tank on the morning of March 15th (on the twenty-third day after laying), and on that day and the next hatching went on, as it had done when the first mass was removed. None of the larvæ from this second mass lived beyond the end of the fourth day. It may again be pointed out that there seemed to be no possibility of the eggs being fertilized in the aquarium.

Would the Bullhead have laid the second mass upon the first if the latter had not been removed? It seems probable that it would, because, as already mentioned, the fish had returned to the first egg-mass on the second day and remained on it for about two hours. The water in the tank was fourteen inches deep, and the first mass of eggs was laid in a situation in which

its upper edge was three and three-quarters of an inch from the surface of the water. The second mass was laid, in another part of the tank, on a little ledge of rock about three-quarters of an inch from the surface.*

It was pointed out above that the Gobies and Prawns did not touch the eggs, but on February 8th (on the eleventh day after laying) an *Asterina gibbosa* was observed upon the first egg-mass, and another of these asteroids was found on it on the 9th. There is no doubt that one at least of the *Asterinæ* was attempting to feed upon the eggs, because, when it was quickly and gently lifted up, its stomach was found to be in the everted condition. It seemed desirable to ascertain which animals in the different aquaria would feed upon the eggs of the Bullhead, and the following experiments were made, immediately before the time of hatching of the eggs.

A third *Asterina*, which was given a small group of the eggs, fed upon them, but a fourth refused them. A hungry Common Starfish (*Asterias rubens*) took them, but a recently fed individual did not. Eggs thrown to six hungry Wrasse were seized before they reached the bottom of the tank, but all of them were hastily disgorged again.† Three individuals of the Blenny (*Blennius pholis*) treated the eggs in the same way. A Hermit-Crab (*Eupagurus bernhardus*) would not touch them. A Long-legged Spider-Crab (*Stenorhynchus phalangium*) picked up a group of the eggs and held them to its mouth, but did not eat them. Three females of the Four-horned Spider-Crab (*Pisa tetraodon*) refused them. A large female Fifteen-spined Stickleback (*Gasterosteus spinachia*) followed and closely examined them as they fell through the water, but did not take them into its mouth. Four individuals of the Purple-tipped Sea-Urchin (*Echinus miliaris*) certainly worked upon two groups of the eggs with their teeth, but it was difficult to see with what result.

Two of the larvæ of the Bullhead, on the second day after hatching, were put into the aquarium containing the Fifteen-spined Stickleback and were immediately swallowed by the latter.

* Holt (*op. cit.* p. 27) mentions that at St. Andrew's eggs were frequently found on perpendicular ledges so as to be wholly or partially out of the water at low tide.

† The same Wrasse eagerly swallowed and retained eggs of the Common Spider-Crab (*Hyas araneus*) about a week later.

NOTES ON THE TREE-SPARROW IN DONEGAL.

BY THE REV. J. M. McWILLIAM.

In the 'Irish Naturalist,' August, 1907, Mr. Robert Patterson published an account of a small colony of Tree-Sparrows found by me that summer in the south of Co. Donegal. I only had these birds under observation for a couple of weeks, and had not the opportunity of going back to the district in the nest season till last June, nor could I get any information as to the continued existence of the colony during the interval of eight years.

In 1907 I found four nests in all, which I believe represented two or three pairs of birds. The nests were quite close to one another, as is shown in the accompanying diagram, and I could find no Tree-Sparrows anywhere else in the neighbourhood, though I was constantly in suitable places for a few miles on each side.

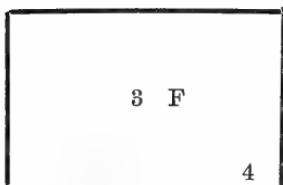
There was one remarkable fact in connection with this colony, to which I shall refer again later. In order to leave no room for doubt about the identification of the birds, I took a pair of Tree-Sparrows with their young, and I subsequently heard from Messrs. Williams, of Dame Street, Dublin, that on examination both of the old birds were found to be males. It was as certain as it could be that both of these males were partners in the same nest (1) (see diagram). I had them under observation immediately beside the nest for some time before I reluctantly shot them. At the same time there was a female sitting on another nest not very far away (2), and I believe that she was the female belonging to this brood. There were no other Tree-Sparrows in the immediate neighbourhood, and I never saw more than two Sparrows feeding the young in the first nest. I assume that the limited number of birds in the colony led to this unusual incident, and that the female left the first brood to lay again in another nest. At least this suggested itself to me

as a possibility; but of the fact of there being two males feeding the one brood of young there was no room for doubt.

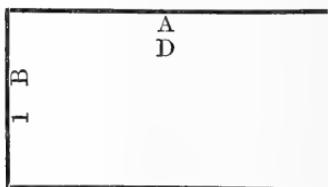
Since 1907 the only information that I could get about this colony was from a reference in the 'Irish Naturalist' (October, 1909, p. 226), to four Tree-Sparrows having been seen near Ballyshannon, a few miles from the place where I found the birds.

Then in July, 1913, there was a very full account published in 'British Birds,' by Professor C. J. Patten, of a much larger

D—GARDEN.



R—GARDEN.



HOUSE.



HOUSE.

About three hundred yards.

S.
—
N.

Sea front.

The broad lines represent stone walls about ten feet in height. The birds breed in holes six or eight feet from the ground in these. The figures represent the nests of 1907. The capital letters represent nests of 1915. "3" and "F" indicate presence of breeding birds, exact nesting site not discovered. The nests "C" and "E" I believe to have been in the nesting-hole that "2" was in. The distances from left to right are larger than indicated.

colony of Tree-Sparrows found by him on Inishtrahull Island, to the north of Co. Donegal. It was not till June, 1915, that I was able to revisit my colony and get the information about it which I now give. I was naturally very glad to find that the colony was still in existence in precisely the same locality, and that the birds had slightly increased in number. I believe that the nests that I found in 1907 represented, as I have said, two or three pairs of birds. The nests that I found this June,

and the adult birds that I saw in different places, must have represented four or five pairs. In each year I believe that I had practically all the breeding birds under observation.

I give the notes from my bird diary. The accompanying diagram shows the different nests to which I make reference in it.

June 6th, 1915.—I went into R—garden and soon saw a pair of Tree-Sparrows feeding their young in a nest (A) in the south wall. I watched the birds at intervals through the day. The young are about half grown. The nest is in just another such hole as the nest that I found here before (1) was in, perhaps fifty yards away from it.

I then went to the wall where I had found the other nest (2) in 1907, and was very much surprised to find a nest there also (C), possibly in the very hole where the birds nested before. Indeed I think that there is little or no doubt about the hole, as I had taken out a stone to get to the nest, and then replaced it. There were young birds in the nest, not very long hatched. I did not see the old birds well enough to identify them with certainty as Tree-Sparrows, but I have no real doubt about them. Later in the day I went over to D—garden where I had seen a pair of Tree-Sparrows with young in 1907 (3), and I found a pair of Tree-Sparrows there also. It is very surprising to find just the same number of birds breeding in just the same situations as in 1907. I did not go into this garden after these Sparrows, but I saw them at a pretty close range, and they were obviously looking after young.

8th.—I went to R—garden. I saw a couple of young Tree-Sparrows being fed on the top of the wall. I do not think that they could be from the nest that I found in the garden (A), as I went to this nest and saw young birds still in it, very well feathered but hardly ready to leave yet. I went to the other nest (C) in the wall of the field, and identified one of the parent Tree-Sparrows with certainty.

I saw one or two nests of the House-Sparrow, but there are certainly not as many of these round the house and garden as there used to be before I found the Tree-Sparrows.

In the afternoon I went out to the garden again. There are certainly more than one pair of Tree-Sparrows round this garden. I had three adult birds in sight at one time.

The Sparrows are very well worth watching. They are far more alert and bright than House-Sparrows. They do not in the least mind my watching the nests from a distance of thirty yards or so, but I can never get very close to the birds. Except by the note, which is very distinctive, it would not be easy to identify them with certainty without a glass.

10th.—I went to R—garden. The young Tree-Sparrows in the nest in the south wall are about ready to leave. I saw one being fed at the entrance to the breeding-hole, and I was not certain that some had not actually left. I saw a Tree-Sparrow going to a hole (B) in the east wall, and went over and found the nest. It was of the usual type and contained five eggs, four with a great deal of dark brown marking and the other with a light ground and some dark markings. The eggs were as small as usual, much smaller than those of the House-Sparrow. The nest was immediately beside the hole where I found the first nest in 1907.

13th.—I went to the Tree-Sparrow's nest in the wall of the field (C). The young are nearly ready to leave.

14th.—The young Sparrows in nest (C) are ready to leave. One of them flew a considerable distance from the nest.

22nd.—I saw a Tree-Sparrow leaving the nesting-hole (A) in the south wall of the garden, that the young birds left a week ago, and when I went over I found that new nesting-material had been brought to the nest. I had wondered why I did not see any old nests of other years round the walls, but apparently the birds are using the same holes repeatedly.

23rd.—There is new nesting-material (E) in the nest (C) in the wall of the field. The birds are certainly using it again. I saw the old birds near the nest, still with the young ones round them. I went into D—garden, and saw a pair of Tree-Sparrows that had obviously got a nest in it. One of the birds was carrying a feather. Both came quite close to me and showed anxiety. I think that there is only one pair (F) there.

25th.—The Tree-Sparrow's nest (E) in the wall of the field has one egg to-day. The birds have added considerably to the nest. They have even used a little green grass. These Sparrows do not seem to mind my being often at the nest. I handled the small birds of the first brood repeatedly, and have been at the

nest several times since they left. A stone has to be removed, too, from the entrance to the nest before it can be examined. There has been a very short interval since the first brood was reared. The young were in the nest, though ready to leave, on June 14th.

26th.—The Tree-Sparrows are still adding material to the nest in the wall of the field, though two eggs have been laid.

28th.—Four eggs in Tree-Sparrow's nest to-day.

On June 28th I had to leave this place.

In his paper in 'British Birds,' Professor Patten raised the question again as to whether this colony could have existed before I found it in 1907. I had stayed in the house, beside which the colony was, during a considerable part of the nest seasons of the two preceding years, and had naturally been frequently in the garden, so I can hardly believe in the possibility of the Tree-Sparrows having been there then. I know how easy it is to overlook birds that one does not expect to find, and in 1907 I had certainly been beside the colony for a week or two before I discovered it; but on the other hand I recognized the birds the first time that I happened to go to the garden; and even before I saw them there I had already found another nest (2) about one hundred yards away, which eventually turned out to be a Tree-Sparrow's, and was keeping it under observation. During practically the whole of this week I had been working at some other birds some miles away, and had taken it for granted that there was nothing to be found in the garden in which I had often been in other years.

Also there had been a large colony of House-Sparrows in the garden, which has much diminished in numbers since I first found the Tree-Sparrows.

But the most interesting evidence for the colony having been newly founded lies, in my opinion, in the fact to which I have referred, of the two males breeding with one female. In the 'Irish Naturalist' for June, 1903, Mr. C. B. Moffat brought forward a number of facts that suggest that the struggle for existence and reproduction amongst birds takes the form rather of a struggle for breeding ground than for the possession of females. His argument was that the female was easily obtainable by a male which had established its claims to a

suitable breeding space. If that be so, one would expect that in a new colony, which had unlimited room for expansion, much of the sexual rivalry amongst the males would disappear. Certainly Mr. Moffat's theory, if I have given it fairly, would find a kind of support from the incident that I discovered. It certainly seemed strange that two males of so active a species as Tree-Sparrows should live so harmoniously together, unless there were very exceptional circumstances, such as an extreme scarcity of birds in an entirely new and isolated colony.

Of course, the fact that the numbers in the colony have since increased forms the most substantial proof that the birds only began to nest here in 1907.

I was interested to see how clearly the young Tree-Sparrows showed the distinguishing marks of their species even before leaving the nest. One which I examined at that stage showed quite distinctly the brown head and black cheeks, and the double bar on the wing. Unfortunately I have not been able to spend a complete nest season in this locality, so I do not know how many broods are reared by each pair, but the dates that I am able to record would suggest that as many as three broods may be reared in the same nesting-hole in a season. Even assuming that two broods only are usual, it is strange that since the colony has held its own, it has not increased at a greater rate. I have worked at birds over most of this district to the south of Donegal Bay, and have been on the look-out for other Tree-Sparrows, but have never seen any. It is hard to believe that they have not formed, or are not forming, other colonies between Inishtrahull and Donegal Bay, or along the Leitrim and Sligo coasts. A census of the Sparrows of both species along this coast would be interesting. I have seen House-Sparrows at every point between Ballyshannon and Grange, in Co. Sligo, but have never seen Tree-Sparrows, except in this one colony, which apparently only extends for a few hundred yards.

A DIARY OF ORNITHOLOGICAL OBSERVATION MADE
IN ICELAND DURING JUNE AND JULY, 1912.

BY EDMUND SELOUS.

(Continued from p. 174.)

IMMOBILITY must be as protective as protective coloration, and perhaps more so, for that would be an unfit species whose eye was deceived by coloration after it had detected motion in one suited to its needs. I have spoken of the immobility of the Golden Plover on its nest. To-day, for the second time, I watched a Red-necked Phalarope under the same circumstances. Some turves have been cut and piled up on each other, almost on the very place where I sat before. I got up upon the highest of these heaps—some three or four feet from the ground—which made a comfortable seat. Almost from the first, my glasses detected something which I first thought was, then was not, and finally was—but not quite certainly—the head of the sitting bird. There was a curvature which seemed quite perfect both for head and neck. It was indeed, all along the outline, of the grey bleached shade of a withered blade of grass, of which there were many all about, but still why had it that curvature? None of the others had. Why, too, was it always motionless though there was a wind—sometimes a little gust of wind—when other blades round about it could be seen to move? So much for the outline, but beyond that outline, or, rather, enclosed by it, I could see distinctly coloration and substance which was not to be explained by any of the scant vegetation—scant, at least, in kind—round about. There was a dark, defined mark on the nape side of the neck, and two others, if I remember, on that of the throat. There was shape too—the required shape—more of it I mean—that of the throat and chin with a suggestion of the beak—just beginning—the rest being hidden. Still the colour of the head and neck outline so

exactly resembling a withered blade of grass—identical with every other one—that however was all as required on protective principles, so ought not to have puzzled me. Taking it all together I felt sure it must represent a bird. But if so its immobility was extraordinary, and I determined to test it. Setting the glasses on the small expanding cane seat of my walking-stick camp-stool I watched the appearance steadily, for half an hour, but could detect no movement. It seemed almost impossible that a bird of any sort, be it never so sitting a one, should not move its head once in that time, but I remembered the Golden Plover, as to which there was no doubt. After this, Whimbrels took off my attention for another ten minutes, but when I looked again, there was the bird's head and neck—outline and shading—just as, and just as motionless as, before. Now I got down from my mound, and fixing my eyes as much as possible on the spot where they had so long been fixed, walked slowly towards it. Nearer I got and nearer, but saw no bird (it was my own eyes now, not the glasses), nearer still, nearer at last than when I had seen it distinctly before there, several days ago, much nearer. The nest then was empty—yes, undoubtedly empty—still for an absolute proof, I thought I would make the few remaining paces, and did so, and off flew the bird, from the very precise spot, as far as I could judge and locate it, where I had located it all the while. Here was a triumphant resolution of all my doubts, of all my laudable precautions against undue assurance. It had been there all the time, just where a blade of grass had seemed to be. I had only to go back now, reclimb my mound, fix the glasses as before—which would be easy, for the whereabouts of the nest was marked—and the absence of any such blade having the curvature of a bird's head and neck would prove the similitude up to the hilt. All which I did, and looked—and there was the curved blade of grass !

The bird had sat somewhere else, and invisible, all the time, whilst I had only looked at an imagined something, and now the whole simulacrum had “softly and suddenly vanished away.”

And yet no, this view can hardly be maintained, in fact is untenable, for, if the curved blade of grass remained, nothing else did that had helped to make the bird—the bird that was on

the nest, which was and is precisely in that place. The deepenings of colour or shade, the soft, undefined outline of throat and chin, the beginning of the bill, all were gone. There was no possible making out of a bird now, from the curved grass-blade alone. However bird-like its curve was, clearly it was only a grass-blade, "merely that and nothing more." The rest had been there, had vanished, and *pari passu* with that evanishment the actual bird was flown. So I reasoned. I could not and I cannot persuade myself that the chance shape of a grass-blade, simulating the not very complex outline of a bird's head and neck, had made me imagine all the rest. It was not a case of aroused expectation, which, moreover, I have always found fail me. My theory was, and is, that there had been a chance combination between bird and grass-blade, in which case—and I feel pretty certain it was the case—the bird's immobility was astonishing, and, now I come to think of it, so was that of the grass-blade. Why it should not have moved, though there was always a wind, I really cannot explain (since it did not appear to be in any way sheltered, and elsewhere there was movement enough), but move it did not. The bird's immobility, however, was voluntary, and it is a little curious that this form of protection, equally, there can be no doubt, the product of natural selection with that of a dull or assimilative colouring, should have aroused hardly any attention—at least in the higher vertebrates—whilst the other has been so taken up that no one seems to know when to put it down. Yet I cannot doubt that, in the degree of its development, it is the more protective of the two. There is no species so quietly coloured as not to be seen when it moves, and none, probably, too bright to escape observation by keeping still.

My first watching of this Phalarope on the nest was on Friday (21st). I then saw it sitting distinctly, as I came close up—perhaps within six or seven paces. The day before (I think) when I had marked the nest, I saw nothing of the bird, so that if it had been on it, it must have walked away—not flown. Remembering this, but not before I had turned and got some distance on my way back, I thought I would test it now, and so walked right up to the nest, which I found empty, not having seen the bird again. It is not very likely that it went off

whilst I was walking away, having let me come so close without moving, so it may either fly or steal from the nest. As incubation advances it probably sits closer, and this strengthening of the brooding instinct might overcome a feeling of caution which would induce it otherwise to retreat as unobtrusively as possible, but I find it difficult to believe that the bird has really this prudent idea in its mind.

It was about 7.30 p.m. (to-day) when I got back to my place, after seeing the Phalarope fly off, and I watched the nest for another three-quarters of an hour before leaving. The bird had not returned during this time.

June 26th.—Started again, on the ponies, after breakfast, and pitched the tent on the shores of a quiet bay of a lake which we had passed travelling up from Reykjavik, in which I had noticed a good many of these little Phalaropes, which are here quite common. They now seemed less numerous, but there were still a fair number, and, when Sigardsson had ridden off, I set myself seriously to observe their habits. They swam about on the still waters of the bay—it is now a calm, still evening, after deluges of rain—in what, at first, seemed an aimless manner, continually altering their course and making sudden little tacks and jerks, all with a funny little nodding motion, as if they were Moorhens “in little.” It soon became apparent, however, that they were feeding, and the only question then was on what. Nothing was visible, but these as well as all the actions, could be explained on the supposition that minute insects were the objects of pursuit, and, since Mosquitos * were everywhere, it seemed likely that they were the staple. As I continued to watch I observed some little peckings in the air, and once there was an aerial pursuit on the part of two of the birds, which presented the counterpart, during the short time it lasted, of their movements in the water. Soon a pair of Phalaropes, and then a third, came down quite close in front of my tent, and, swimming to the bank, began to hunt something right under it, then, coming out, any little patches of weed were investigated, as well as rocks jutting out from the shore, the birds sometimes walking over these. Wherever they

* I hear now that they are Flies, and not really Mosquitos. But as Mosquitos are really Flies, and as these Flies bite severely, I shall continue to speak and to feel about them as if they really were.

went I followed, and in all these places were Mosquitos—as where were they not?—yet still I could never actually see one pursued and caught; but this was soon to be vouchsafed me. A tiny rill, which winds here amidst tiny hills, clothed with tiny birch trees and only at its mouth becomes stream-like, debouches, if so large a word may be used of it, into this part of the lake; and along its windings fringed on each side with masses of grey stone-like slag that have become moss-covered and even support stunted tree-bushes, I followed one of these Phalaropes, and in the little fairy pool, in which the expansion of its waters begins, I saw this bird excitedly pursuing and deftly catching these pests, and that at so close a distance that the glasses were not at all needed, though they greatly added to the vindictive pleasure of the sight. The avenger—alas! how imperfect a one—turned, zig-zagged, skurried, strained upwards, pressed, in a foot's length, to all points of the compass, and especially kept hugging every nook, angle, jetty, or little indentation of the shore, and almost at every little pretty, soft snap, might have said, like Cleopatra to her “betrayed” fishes, each representing an Antony—“Ah, ha, you're caught!” Then out of some similar configuration, swam the other riparian investigator—larger than the first, its partner evidently, which, if all tales be true, should make it the female—catching Mosquitos all as ardently. There was nothing but Mosquitos, and nothing more seemed wanted. The air was full of them, and never was hunt more successful. Never, too, surely, could a pair of little birds have been seen, prettier, at once, and occupied more meritoriously. The first perhaps, and the second just possibly, but surely not the two in conjunction.

(To be continued.)

A CATALOGUE OF THE LAND AND FRESHWATER MOLLUSCA OF SUSSEX.

By E. W. SWANTON.

(Member of the Conchological Society; Curator of the Educational Museum,
Haslemere.)

(Continued from p. 268.)

(PLATE III.)

Helicella itala, Linné (= *H. ericetorum*, Müller).—Widely distributed, abundant on the Downs, absent from the Vectian sands. Subject to great variability in size and colouring. Mr. Jenner has taken shells 20 mm. in diam. at Eastbourne, and dwarfed specimens on the Downs near Lewes. The Rev. W. A. Shaw has found this species in a Holocene deposit at West Stoke.

Var. *hyalozonata*, Cockerell.—Near Beachy Head (A. G. Stubbs); Rottingdean (F. Burrows); Friston, near Eastbourne (C. H. Morris).

Var. *leucozona*, Moquin-Tandon.—Downs near Lewes (Jenner); Heyshott Down (E. W. S.).

Var. *alba*, Charpentier.—Lewes (T. S. Hillman); Kingston Hill (C. H. Morris); Downs at Lewes, Seaford, and about Beachy Head (Jenner).

Var. *bizonalis*, Moquin-Tandon.—Near Lewes and Seaford (J. H. A. Jenner).

Var. *coalita*.—Downs near Eastbourne (Rev. W. L. W. Eyre).

Var. *griscescens*, Colbeau (= *subpellucida*, Jenner).—Wilmington Hill (J. H. A. Jenner).

H. caperata, Montagu. (Plate III.)—Generally distributed. Borrer noted that it is very partial to clover fields, and is a favourite morsel with the Land-Rail. The Rev. W. A. Shaw has found it in a Holocene deposit at West Stoke. Large forms have been observed

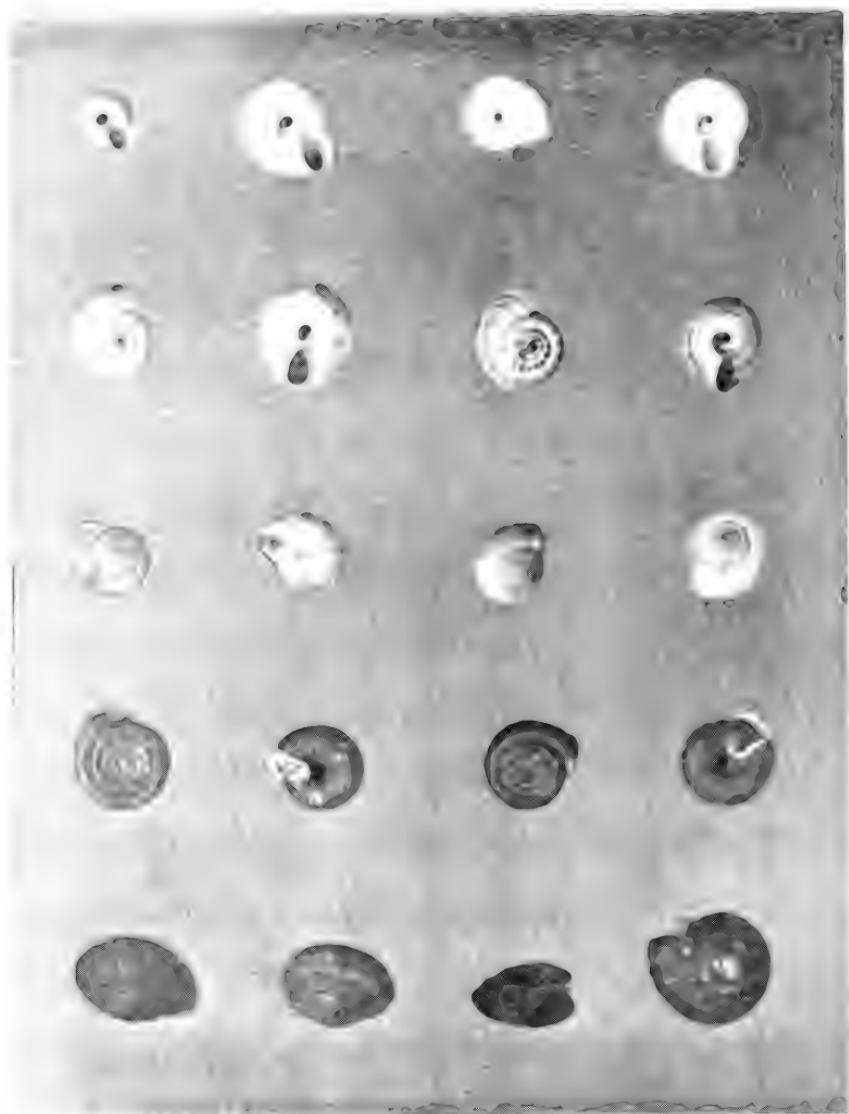


Photo W. H. Thornton.

SUSSEX MOLLUSCA.

HELICELLA CAPERATA, *H. HERIPENSIS*, *H. CARTUSIANA*, *HELICODONTA OBVOLUTA*, and *HELICIGONA LAPICIDA*. (See p. 319).

by Mr. Jenner on the Downs about Lewes, and by Mr. C. H. Morris at Cliff Hill, Ranscombe, and at Eastbourne.

Var. *ornata*, Picard.—The Rev. S. Spencer Pearce has suggested that the conspicuous dark band which characterizes this variety, causes it to be avoided by sheep. Lewes (T. S. Hillman); locally common on the Downs near Lewes (J. H. A. Jenner); Hastings, common (Hastings Philosophical Society); Heyshott Down (E. W. S.).

Var. *alba*, Picard.—Lewes (C. H. Morris); Ranscombe, near Lewes (J. H. A. Jenner); near Little Common, Bexhill (Rev. W. A. Shaw).

Var. *bizonalis*, Moquin-Tandon.—Near Lewes (J. H. A. Jenner).

Var. *fulva*, Moquin-Tandon.—Near Lewes (J. H. A. Jenner).

Var. *obliterata*, Picard.—“Victoria Drive,” near Eastbourne (A. G. Stubbs); Kingley Vale, near Chichester (Rev. W. A. Shaw).

Var. *gigaxii*, Charpentier (? *H. heripensis*, Mabille).—“Some shells from the Downs about Lewes are perhaps the var. *gigaxii*” (J. H. A. Jenner); occasionally in the Chichester district, where the “species generally has a tendency to this form” (W. Jeffery).

Var. *subscalaris*, Jeffreys.—Near Lewes (J. H. A. Jenner).

Monst. *sinistrorum*.—A full-grown specimen on the golf-links at Lewes (C. H. Morris).

H. heripensis, Mabille. (Plate III.)*—This species was first recorded as British by Mr. A. W. Stelfox in Proc. Malacological Society, March, 1912. It bears the same relation to *H. caperata* that *Vallonia excentrica* does to *V. pulchella*, the chief distinguishing feature being the wide, deep, and excentric umbilicus which exposes the coiling of the whorls. The Rev. C. E. Y.

* DESCRIPTION OF PLATE III.—Line 1: Three shells of *Helicella heripensis*, Mabille, var. *albicans*, Kendall, and one (the extreme left) of typical *Helicella caperata*, Montagu, to show the difference in the umbilicus. Line 2: Four shells of typical *Helicella heripensis*. Line 3: Four shells of *Helicella cartusiana*, Müller. Line 4: Four shells of *Helicodonta obvoluta*, Müller; the second on the left shows the white epiphragm which covers the mouth of the shell during hibernation. Bottom line: at the extreme left a typical shell of *Helicigona lapicida*, L.; adjacent is the var. *ecarinata* subvar. *subangulata*, Pascal; to the right are two scalarid shells, monst. *scalare* subvar. *subscalaris*, Grateloup. All natural size.

Kendall remarks (Journ. Conch., July, 1912) that variation in colour exists to a certain degree, but does not seem so great as in *H. caperata*, that it is strongly calcophilic, and also xerophilic, occurring always on dry pastures, and that it is probably not a "strong" species, as it seldom seems to be the dominant. Lewes, 1908 (Rev. C. E. Y. Kendall); Ovingdean, near Brighton, November, 1910, very fine specimens (Rev. C. E. Y. Kendall).

Var. *albicans*, Kendall.—Near Brighton (Rev. C. E. Y. Kendall).

H. barbara, Linné (= *Helix acuta*, Müller).—Recorded only from the neighbourhood of Eastbourne and Hastings. Mr. Jenner remarks that "this species is now lost to East Sussex, the ground where it occurred at Eastbourne having been built upon [near Mill Gap]. The form which occurred there was white, opaque, and very large, some specimens reaching 18 mm. in length. I have searched the coast of Sussex from Brighton to Rye, in every likely place, without finding another locality for this shell, and it seems most probable that this now extinct colony was introduced" ('Journal Conch.', vi., July, 1891). Mr. A. J. Alletsee has recorded its occurrence at Ore, Hastings.

H. cantiana, Montagu.—Generally distributed, excepting on the Vectian sands about Blackdown.

Var. *rubescens*, Moquin-Tandon.—Near Lewes (J. H. A. Jenner); Guestling (Hastings Phil. Soc.); Ore, Hastings (A. J. Alletsee).

Var. *albida*, Taylor.—Near Lewes (J. H. A. Jenner and C. H. Morris).

H. cartusiana, Müller. (Plate III.)—Captain Thomas Brown wrote (in 1844):—"This species inhabits the chalk districts of Sussex and Kent, among short grass, and is also common on the coast between Dover and Brighton." Mrs. Merrifield remarked in her 'List of the Land and Freshwater Shells of Brighton' (1864) that it is "particularly abundant on our chalk Downs near the sea." Mr. Jenner says "it occurs on the chalk, rather common, but very local" (as is indicated by the recorded stations for it); he has taken large forms 15 mm. in diam. in several spots near Lewes. Downs near Lewes in several places (J. H. A. Jenner); Malling Marsh, near Lewes (Ed. Collier, Journ. Conch. xiii. 285); Lewes, on stunted grass near Mount Caburn, and on Ranscombe Brow, very local (W. C. Unwin); near East Dean on

the Downs, Eastbourne (A. G. Stubbs); between Blatchington and Seaford (Eastbourne Nat. Hist. Soc.); Shoreham (W. Jeffery); Littlehampton (Gwyn Jeffreys).

Var. *rufilabris*, Jeffreys.—Lewes (T. S. Hillman and Gwyn Jeffreys); Littlehampton (Gwyn Jeffreys); Ranscombe (J. H. A. Jenner).

Var. *lactescens*, Picard (= *alba*, Jenner).—Lewes (J. H. Jenner and T. S. Hillman).

Hygromia fusca, Montagu.—A Lusitanian species of great rarity in Sussex. Mrs. Merrifield, in 'The Natural History of Brighton' (1860), remarks that it is "rare in this neighbourhood, found occasionally creeping among brambles"; Mr. W. C. Unwin found two specimens in Warrington Wood, Lewes (1852); and Mr. W. Jeffery has recorded it from Ratham, near Chichester (1882), see Journ. Conch. iv., 17. It is of interest to note that the Rev. W. A. Shaw has recorded it from Surrey, on the slopes of Hindhead, only a few miles from the Sussex border (1911).

H. granulata, Alder (= *sericea*, Jeffreys).—A rare species. It has been found by the Rev. W. A. Shaw in a Holocene deposit near West Stoke, Chichester; Mr. Jenner records it from Cowfold and Henfield, and Mr. Guermonprez from Bognor. "It is recorded as taken at Hastings in 'Diplock's Guide,' but has not been met with recently" (J. H. A. Jenner).

H. hispida, Linné (= *H. concinna*, Jeffreys).—Generally distributed.

Var. *hispidosa*, Mousson (= *H. hispida*, Jeffreys).—Widely distributed.

Var. *depilata*, Alder.—Lewes and Ashcombe, not common (W. C. Unwin); Up Park (F. Townsend, Haslemere Museum collection).

Var. *albida*, Jeffreys.—Pevensy (A. J. Alletsee); Hastings (Hastings Phil. Soc.); West Stoke (Rev. W. A. Shaw).

Var. *subrufa*, Moquin-Tandon.—Lewes (Jenner); Mount Caburn (Morris); near Hastings (Hastings Phil. Soc.); Heyshott Down (E. W. S.).

Var. *nana*, Jeffreys.—Heyshott Down (E. W. S.).

Var. *conica*, Jeffreys.—Hastings (Hastings Phil. Soc.); Brighton (specimens in Rufford collection, Hastings Museum).

H. rufescens, Pennant.—Generally distributed. The Rev.

W. A. Shaw has found it in a post-Pliocene deposit at Kingley Vale, West Stoke (1912).

Var. *albocincta*, Cockerell.—Amberley Castle (D. Taylor); Winchelsea (Rufford Collection, Hastings Museum).

Var. *rubens*, Moquin-Tandon.—Near Lewes (Jenner); Winchelsea (Rufford Collection).

Var. *alba*, Moquin-Tandon.—Lewes (C. H. Morris and W. C. Unwin); Winchelsea (Rufford Collection); Eastbourne (Hastings Phil. Soc.); Chanctonbury Ring (E. W. S.); Heyshott Down (E. W. S.); West Stoke, near Chichester (Rev. W. A. Shaw).

Acanthinula aculeata, Müller.—Widely distributed. Specimens in the Haslemere Museum were collected at Hastings by F. Townsend in 1850. There are numerous records from both divisions of the county.

Vallonia pulchella, Müller.—Probably generally distributed, but the numerous published records of its occurrence at Lewes, Hastings, and Eastbourne, and about Harting and Chichester, were made before the form with excentric umbilicus (*V. excentrica*, Sterki) was raised to specific rank.

V. costata, Müller.—According to Dr. Sterki the presence of very fine raised revolving lines on the nucleus of the one and a half embryonal whorls distinguishes this species from *V. pulchella*, in which the nucleus is smooth. East Hill, Hastings (A. J. Alletsee); Eastbourne and Lewes (Jenner); Steynings (Rev. C. E. Y. Kendall); Chanctonbury Ring and Heyshott Down (E. W. S.); West Stoke, near Chichester (Rev. W. A. Shaw), about Ifield and Rusper (E. W. S.).

V. excentrica, Sterki.—Formerly confused with *V. pulchella*, from which it differs in the markedly excentric and less open umbilicus, and the more impressed sutures of the inner whorls. Near Kingley Vale, Chichester (Rev. W. A. Shaw); Verdley, near Midhurst (E. W. S.).

Helicodonta obvoluta, Müller. (Plate III.)—This species, being of exceptional interest, the records of its distribution in Sussex require consideration in detail. It is of Lusitanian origin. Its range in Britain at the present time is the South Downs over a tract in Sussex and Hants about thirty-five miles in length, and about six miles in breadth. It is not dispersed entirely over that area, but occurs in isolated colonies; in some spots only dead

shells are found, *e. g.* the Rev. W. A. Shaw found it in a post-Pliocene deposit at Kingley Vale, near Chichester, an indication that it is a waning species, which is supported by the occurrence of dead shells only in parts of Surrey and Kent. It is always associated with beech trees, ascending the trunks in spring upon emergence from hibernation and spending the summer on the branches. To secure living specimens it is necessary to visit the trees at the time of the spring ascent or the autumn descent, for amongst the moss and leaves at the base only dead smooth shells are met with; living specimens of all ages show the epidermis clothed with hairs.

Some years ago, upon pointing out the shell to an old gamekeeper at Ditcham, he remarked that he knew it well, and that once when digging out rabbits in the wood in winter he came across some of the shells "stuck together in a lump as big as my fist," an observation tending to show that these molluscs assemble for hibernation in the manner often adopted by *Helix aspersa*. I gave him my address, and promised to send him half-a-crown upon receiving a similar "lump," but the reward has not been claimed. As in *H. pomatia* the mouth of the shell is closed by a thick, white, chalky epiphragm during the period of hibernation. Weaver alludes, in 'The History of Harting' (1877) to the first British record of it (in 1830) by Dr. James Lindsay in Ditcham Wood on the Hants border, and adds: "We have since found it in another locality near Up Park, where, within the last dozen years or so, they were so plentiful that we have collected as many as thirty or forty specimens in less than three hours on several separate occasions."

Mr. Clement Reid exhibited specimens before the Linnean Society on December 18th, 1890, and showed by aid of a specially prepared map its present very local distribution in England. He informs me that it is quite common where it occurs, and is associated with *Clausilia roolphii*, and with plants belonging to ancient woods. It does not occur in the eastern division of Sussex. The following are the recorded stations in the western part of the county. "Specimens evidently only recently dead, amongst moss at the roots of trees on a bank at Dunton" (T. Godlee, J. C., 1895); dead shells only at Woodend "at the base of the Downs" (W. Jeffery); Winden Wood, near Arundel

(Clement Reid); all along the hillside from Buriton (Hants) to the dell, Treyford, where it is common, in beech woods chiefly, and specially near water (J. Gordon); Singleton and Graffham (W. Jeffery and many others); Bignor Hill; Glatting Hangar; Farm Wood, Sutton, Barlavington Hangar, and Woolavington Hangar (Clement Reid); Hangar above Heyshott Farm (E.W. S.); William Wood, Up Park (Rev. W. A. Shaw).

Helicigona laticida, Linné.—Widely distributed, particularly abundant in beech woods.

Var. *ecarinata*, A. Schmidt. (Plate III.)

The subvar. *subangulata*, Pascal, has been taken at Lavant by the Rev. W. A. Shaw.

Var. *albina*, Menke.—Light greenish white specimens at Lavant, May, 1904 (Rev. W. A. Shaw).

Monst. *scalare*, Charpentier. (Plate III.)

The subvar. *subscalaris*, Grateloup, has been taken at Lavant by the Rev. W. A. Shaw.

H. arbustorum, Linné.—Widely distributed, but absent from the Vectian sands about Blackdown. Mr. P. J. Johnson has found it in a Pleistocene deposit on the foreshore at West Wittering.

Var. *picea*, Rossmässler.

Subvar. *fusca*.—Ecclesbourne Glen, Hastings (G. H. Rowe).

Var. *flavescens*, Moquin-Tandon.—Lewes (J. H. A. Jenner and others); Bopeep, Hastings (Hastings Phil. Soc.).

Var. *fuscescens*, Duchaisson (= *marmorata*, Taylor).—Lewes, Pells, and Landport (Jenner); between Robertsbridge and Hurst-green (T. D. A. Cockerell).

Var. *cineta*, Taylor (= *pallida*, Taylor).—Pells, Lewes (T. S. Hillman).

Var. *conoidea*, Westerlund.—Pells, Lewes (J. H. A. Jenner).

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Natterer's Bat in Staffordshire.—The first authenticated occurrence of this Bat in Staffordshire, of which I have knowledge, has recently been recorded by Mr. B. Bryan, of Longton, Staffordshire. For many years he and I have been working out the Bats of our county, and on the evening of May 6th last, about a mile from Longton, one of the towns now constituting the Borough of Stoke-on-Trent, he observed, about 7.30 p.m., in broad daylight, a Bat flying leisurely, and with an undulating flight, apparently hawking flies just over the grass by the side of the road. He managed to catch the little animal, and at once saw it was a Reddish-grey or Natterer's Bat (*Myotis nattereri*, Kuhl.). The identity of the species has since been confirmed by several leading authorities on the subject. Although quite uninjured, the Bat refused to feed in captivity, an unusual thing with most British Bats, and died. This makes the eighth species on our Staffordshire list (see my paper on "Staffordshire Bats" in the 'Transactions of the North Staffordshire Field Club,' vol. xlvi. 1908, p. 12). Natterer's Bat appears to have been recorded only once for the counties of Salop, Derbyshire, and South Lancashire (see Coward & Oldham's 'Fauna of Cheshire,' p. 12), and the distribution and range of our British Bats still wants working out. I shall be glad to receive specimens for identification from any part of England.—JOHN R. B. MASEFIELD (Rosehill, Cheadle, Staffordshire).

Albinism in the Serotine Bat.—A Serotine Bat (*Vesperugo serotinus*, Blas.) sent to me by Mr. F. E. Blagg, from Hampshire, in the flesh, on July 5th last, has a band of white fur extending across the breast of the animal. This gives the Bat a most striking appearance, and is, as far as I am aware, the first instance of any trace of albinism or other colouration variation in this species. Mr. A. Whitaker, of Barnsley, informs me that albinos have been recorded in the Barbastelle, Long-eared, Daubenton's, Whiskered, Lesser Horseshoe, and Pipistrelle Bats. Also cream and buff varieties of the

Long-eared Bat, and melanic and other varieties of the Pipistrelle.—
JOHN R. B. MASEFIELD (Rosehill, Cheadle, Staffordshire).

Colour Discrimination in Dog; Dog separating Combatants.—A Russian Sable Pomeranian will not go near anything red, and has a decided preference for pale blue. Repeatedly rags of each colour have been given him to play with, and he has never been known to touch a red one, while the blue or green have been ripped to pieces in a very short space of time. A Retriever was nicknamed the "Policeman" because he would always separate two other Dogs who were fighting, or those which looked as if they might. He would always tackle the aggressor, and not leave him until the dog attacked was safely away.—(Miss) R. HOLLOWAY.

Vegetarian Appetite in Cat.—It was never safe to leave a Persian cat near cucumbers. He has often eaten one in the night. Besides this, he has a distinct love for peas, beans, grapes, figs, dates, and potato-parings.—(Miss) R. HOLLOWAY.

A V E S.

Singular Nest of Willow-Wren.—This morning, August 4th, 1915, I noticed a small bird fly into a Crimson Rambler rose on the old wall which divides my garden from a neighbour's. I sent my gardener for a ladder, and found, at a height of about eight feet from the ground, the nest of a Willow-Wren, with young birds just ready to fly. Two or three of them, which we disturbed, are now about the lawn, giving their parents much anxiety; the rest are still being fed in the nest, which is so overweighted as to look almost like a Sparrow's nest with poultry feathers hanging out. No doubt there are records of this species breeding late, and placing the nest high above the ground; but the combination, I imagine, must be unique.—W. WARDE FOWLER (Kingham, Chipping Norton).

Notes on the Laying of the Cuckoo and the Removal of Eggs of Foster-Parent.—Although so much has been written of the life-history of the Cuckoo, there still appear to be many queries that require additional observations recording, and it would be of interest if those who have information at first-hand would give their personal experiences. The Cuckoo evidently does not wait until a full clutch is laid by the foster-parent, but places its egg in the nest when one or more eggs have been laid. I have never known an instance, however, of its eggs being placed in the nest before an egg had been

NOTES AND QUERIES.

deposited therein by the foster-parents. Occasionally the egg of the Cuckoo is the only egg found within the nest, but the probability is that the first egg of the foster-parent had already been removed. Again, I know the Cuckoo will deposit its egg several days after the foster-parents have started incubation, but what is known of the longest time allowed to elapse before so doing? Personally I believe this time is limited; if so, we must credit the Cuckoo with an instinct of knowing to what extent incubation has already taken place. The incubation of the egg of the Cuckoo is evidently more rapid than the eggs of the usual foster-parents, giving the dual advantage to the young Cuckoo of being hatched first, or, if the eggs had been deposited after the foster-parent had commenced to sit, then of being hatched at least about the same time. The same species of foster-parents are not invariably chosen by each individual Cuckoo, but, on the other hand, I believe the Cuckoo does frequently restrict itself to one kind of foster-parent as far as possible, so much so, as to considerably retard the time of its laying, as, for instance, when using the nest of the Reed-Warbler, which would be weeks after eggs of other Cuckoos had been deposited in such nests as the Pied Wagtail, Hedge-Sparrow, Robin, or Meadow-Pipit. And further, the Cuckoos that utilize the former nests are necessarily delayed in their return migration. I have recorded an instance ('Zoologist,' July, 1915, p. 270) of the Cuckoo laying four eggs all in the nests of Reed-Warbler, and I have known several instances where the same bird has laid at least several eggs in the nests of the same species of foster-parents; and, again, where one Cuckoo had selected nests of various kinds of foster-parents—in one instance a Greenfinch, Brown Linnet, and Chaffinch being chosen. How many eggs of the foster-parent are usually removed by the Cuckoo, and what actually becomes of them? In my experience I have only known two nests, those of a Sedge-Warbler and a Hedge-Sparrow, where I knew the complete clutch of the foster-parent was left intact, and such exceptions may prove nothing more than that the Cuckoo had been disturbed before it had time to carry out its full intentions. As a rule I believe at least one and often two eggs are removed and possibly three, but I have no actual proofs to support the latter statement. That the Cuckoo can lay a type of egg to assimilate to those of the foster-parents has often been asserted, but all my personal experience has been that the one female shows a remarkable similarity in each of her eggs, irrespective of the foster-parents, and, moreover, this similarity is continued year by year. And, further, the young of the Cuckoo inherits to a

great extent the type of egg laid by the parent bird.—J. STEELE ELLIOTT.

Calling of the Cuckoo in July.—The late Mr. Howard Saunders in his 'Manual of British Birds' states that the Cuckoo calls up to June 20th. To fix such a precise date is rather an emphatic statement for such an authority to make, and certainly one that is in error. That the continuous calling ceases about that date would have been more correct, but I have many notes from Bedfordshire of their calling even in July. My friend the late Mr. J. King heard the Cuckoo at Biggleswade as late as July 8th in 1897, and until July 17th in 1899, a female on July 6th and a male on July 9th in 1900, July 4th in 1901, and July 15th in 1902. Personally I heard them frequently in various localities up to July 7th in 1907, and in the present year at Turvey on July 4th, when at 6 a.m. I heard a female call once and a male call loudly and frequently for some ten minutes or more. That in some localities the calling ceases at a much earlier date than in others I am fully aware, and at my home in Shropshire, where I have kept close observation the present year, I have not heard or seen an adult since June 16th. The return migration of the adult Cuckoo is given as in July and August, but I think it practically takes place as soon as their calling ceases and the majority of our birds have taken their departure even before the end of June. It is unfortunate that the Reports of Migration printed in the 'Bulletin' of the British Ornithologists' Club throw very little light on the return movements of the adult Cuckoo, as in the few records given so very few state whether such refer to the old or young birds.—J. STEELE ELLIOTT.

Buff-backed Heron in Somerset.—A specimen of the Buff-backed Heron was shot at Martock, Somerset, on January 28th, 1909, and preserved as a skin by a Mr. Sherring. I received the specimen from a friend of Mr. Sherring, and sent it to Mr. Ogilvie-Grant, who verified my suspicions as to the species. The data are preserved, pinned around the neck of the bird, which unfortunately has a rather neglected appearance. This is, I think, the only occurrence in Somerset, and a rarity for any part of England.—STANLEY LEWIS (Wells, Somerset).

Notes on Nest-boxes.—Our nest-boxes this season have contained nothing new or of special interest, except the brood of Tawny Owls already recorded on p. 232. Three boxes have been occupied by Stock-Doves, but they have not been very successful, as I believe only one brood got away. In one case both eggs had been taken out

of the box and lay on the ground under the tree, one broken and the other intact. What marauder had done this is a puzzle. In other boxes we have had Great Tit, Blue Tit, Coal Tit (one), Nuthatch (one), Tree-Sparrow (many), House-Sparrow, and Starling. The box used by the Nuthatch had been in the same place for quite twenty years, and fell down when there were two or three eggs in it, but though it was mended up and replaced, the bird did not return, nor did she use another box. Tree-Sparrows have taken more boxes than was desirable, and have greatly increased in numbers during the last few years. The nest can be easily distinguished from that of the House-Sparrow, as it usually contains moss and fresh green leaves, and is much more tidily put together.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

Migration of Swifts.—By far the largest concourse of Swifts (*Cypselus apus*) I have ever witnessed in the Midlands was over the Dowles Valley, near my home, at 6 p.m., on August 9th. My son and I each estimated their numbers at upwards of five hundred birds, and they covered an area in the sky of perhaps half a mile across, and were at an altitude of about 1000 ft. Although the air was charged with insect life, at least at a lower altitude, they did not appear to be feeding, but gathering together for a migratory movement. Numbers of them circled out at times to various points of the compass, but they all eventually, but very slowly, passed away southwards, since when I have not observed any Swifts remaining in this locality.—J. STEELE ELLIOTT.

PISCES.

Four-bearded Rockling in the Colne.—Yesterday, July 22nd, 1915, in dredging for Oysters in the River Colne, near Brightlingsea, Essex, a specimen of this fish (*Motella cimbria*) was caught in one of the dredges. Its rarity excited attention from the dredger men, and the manager of the fishery, Mr. Trussell, found there were only four, as he termed them, worm-like appendages to its mouth. When I showed him Day's 'Fishes,' he at once recognized the fish. Unfortunately the fish was not preserved, but was thrown overboard again with other rubbish from the dredge.—HENRY LAVER (Colchester).

Behaviour of a Captive Rockling.—The Five-bearded Rockling whose behaviour was described by me in a paper in the May issue of 'The Zoologist' (pp. 190-193) died on June 10th. I should like to point out that there were no alterations in its behaviour beyond those which were described.—H. N. MILLIGAN.

CRUSTACEA.

The Resting-place of a Velvet Crab.—On the morning of February 9th a large male Velvet Crab (*Portunus puber*) was placed in an aquarium. It at once began to explore the tank, and to climb amongst the rocks. Some time before the next morning it had selected a cavity in the base of the rock-work at the back of the aquarium, and henceforth this cavity became its resting-place. The cavity was sufficiently deep to allow the Crab to sit inside, with only the front portion of its body and the great claws projecting. The Crab died on July 3rd. During the whole of the twenty and a half weeks it had lived in the tank it had never voluntarily moved more than four or five inches away from the entrance to the resting-place, and even these short excursions were always on the floor, never on the rocks, and were undertaken only under the stress of hunger. If the Crab was annoyed with the end of a rod, it would strike vigorously with its claws. Even if driven out of its hole it would move only a few inches away and then sit waiting for an opportunity to slip back again. I have several times gone to its tank after nightfall and suddenly turned on the electric light, but I never found it wandering about the aquarium. It would sometimes seize passing Prawns with a very quick and sudden inward movement of its two claws, and eat them whilst sitting at the mouth of its hole.—H. N. MILLIGAN.

INSECTA.

Hornets' Nest in the Ground.—Some of the lads in our village school reported the finding of a Hornets' nest in a furze-bush, and, being rather doubtful, I went to look at it. A boy who acted as my guide assured me, "If you poke them up they'll come out." His remark was quite accurate; I did poke them up, and they did come out. To destroy the nest I had to find the entrance-hole, which was in the ground under the bush, and one of the Hornets stung me on the right cheek. The effect of the sting was not nearly so severe as I expected. I got home as soon as I could and applied my usual remedy of whisky well rubbed in, with the result that the swelling was very slight, and the pain no more than that of a Wasp-sting, while the after-effect was practically *nil*. Last year (*vide* 'Zoologist,' 1914, p. 277) a Hornet's nest was begun in one of our bird-boxes, but this was the only nest I have ever seen in the ground. One dose of cyanide fluid made an end of it, and the boys dug out the comb, the queen being produced for my inspection.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

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THE ZOOLOGIST

No. 891.—*September 15th, 1915.*

THE REPTILES OF THE MALTESE ISLANDS.

By G. DESPOTT.

Of the vertebrates of Malta this is the class that is most poorly represented, numbering only seven species; amongst them, however, are found a variety and a form or two of particular interest, they being peculiar to some of the islets composing the Maltese group.

Beginning with the Geckos, we have: (1) the Turkish Gecko (*Hemidactylus turcicus*, Linn.); (2) the Wall-Gecko (*Tarentola mauritanica*, Linn.).

The Turkish Gecko is found more commonly inside houses, not only in villages but even in towns. According to my personal experience, I can say that this species is by no means common.

The Wall-Gecko is also met with at times inside houses; it prefers, however, the country, where it is rather abundant, inhabiting the crevices of rocks and old walls, out of which it emerges at twilight. Of this species, individuals are found of a very dark, almost black, colour; these seem to be more arboreal in their habits, showing a predilection for the old trunks of trees, orange trees especially.

Both these species are oviparous, laying two white hard-shelled eggs, the size of a moderately-sized pea. I often kept these eggs, which in due course hatched, independently, apparently, of a fixed temperature. The young of the Turkish Gecko are at first very dark and have banded tails. As they grow they

become lighter in colour, and the bands on the tails gradually disappear.

It is a common belief here that both our Geckos have the power of inflicting leprosy on those who touch them; this is, however, only a prejudice, the poor creatures being perfectly harmless. This belief, however, is the cause of a most cruel persecution of these reptiles; and so general is it also that, no matter how good the offer one makes, he will find the greatest difficulty in getting a boy to collect Geckos for him.*



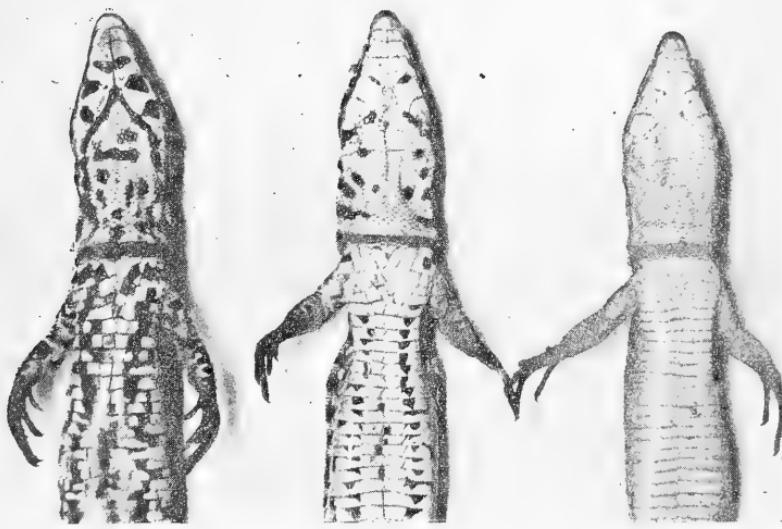
The Lizard from Filfola.

The typical Lizards are represented by one species with a variety and one or two forms, which are the following:—(1) the Wall-Lizard (*Lacerta muralis*, Laur.); (2) the Filfola Lizard (*Lacerta muralis* var. *filfolensis*, Bedr.); (3) the St. Paul's Islands Lizard; (4) the Fungus Rock Lizard (*Lacerta generalensis* ?, Giulia).

The typical Wall-Lizard is abundant both in Malta, Gozo, and Comino, and it can be seen basking in the sun on almost any stone out in the country, even during the fine days of winter, hibernating (if its short disappearance during rainy days can be

* Prof. Giglioli, of Florence, was of opinion that the *Phyllodactylus europaeus* must be found in Malta. Dr. Giovanni Giulia, however, who made most diligent researches for it, states that he has not yet succeeded in finding a specimen, nor have I.

called hibernation) for a very short time. In colour this Lizard is so variable that it is most difficult to find two specimens perfectly alike. The females and young males are of a very sober colour, being brown, generally with longitudinal stripes of darker brown on the back, and whitish or bluish or yellowish white on the under parts. The adult males, during the spring especially, possess the most gorgeous hues; their emerald-green



1. Fungus Rock Lizard. 2. St. Paul's Islands Lizard.
3. Typical Wall-Lizard from Malta.

backs (in some being varied with black or yellow, or both) and their bright orange under parts, and their flanks of a most delicate cerulean blue, make them so conspicuously beautiful as to be admired even by those who shudder at the mere mention of the word Lizard.

The Filfola Lizard, which is a variety of the species just described, is peculiar to Filfola, an islet about one mile in circumference, situated at not more than three miles away from the south coast of Malta. In size this variety surpasses the typical Wall-Lizard, often attaining a length of ten or even eleven inches. Its general colour is a deep charcoal black, having, however, markings in other colours which make it almost as

variable as its congeners of Malta. Individuals entirely black, which are the rarest, have the flanks of a beautiful cobalt blue; the more common sorts have green, yellow, or yellowish green spots on the back, and in these the flanks are of a cerulean blue. The under parts are, in some, of a leaden grey; in others, yellowish; in others, a vivid light red or reddish brown; in some, again, the flanks and cheeks are of a delicate pea-green.

A very striking character in these Lizards is their remarkable tame ness, which makes them so suitable for keeping in vivaria; I have never succeeded, however, in making them breed in captivity.

The Filfolas are known amongst English people by the name of Maltese Blue Lizards, owing perhaps to the blue on the flanks, which amount of colour is, in my opinion, not enough to justify such a name.

The majority of the Maltese believe that the Filfolas have a double tail; in fact, when they speak of Filfola, they state that the Lizards there, which they also know to be peculiar to that rock, possess a pair of tails, without saying anything of the special colour and dimensions. This belief is, of course, quite incorrect. A freak individual can be found at times; these freaks, however, can be met with also amongst the common Lizards, and the doubling of the tail can be also brought about artificially.

The St. Paul's Islands Lizard.—This form inhabits the islets at the mouth of St. Paul's Bay, and was noticed by me in 1913.* It is identical with the typical Wall-Lizard in nearly every respect, having as a peculiarity only some black spots on the under parts, which spots are not found in the common Lizards, and seem to be also wanting in young individuals of the present form; at least, among hundreds of young individuals I examined, I did not find one with any sign of black.

The Fungus Rock Lizard.—This most interesting form was discovered by Dr. Giovanni Gulia in 1914 on the Fungus or General's Rock, a steep little islet, only a few yards distant from the western coast of Gozo, and just at the mouth of the inlet

* Dr. J. De Bedriaga has told me of the existence in our islands of a Lizard with spotted under parts; its habitat, however, was not known.

called Cala Dwejra. In this Lizard the black spots on the under parts are still more confluent and conspicuous than those of the foregoing form, and so also are the black markings on the back. Both this and the form from the St. Paul's Islands seem to be very interesting links between the Filfolas and the typical Lizard of Malta. The name of *Lacerta generalensis*, given to this Lizard by its discoverer, seems to me not to be quite suit-



Fungus Rock Lizard discovered lately by Dr. Gulia on the Fungus Rock (Gozo).

able, as it leads people to think it is a new species, while its characters are not even sufficient for taking it as a variety, though there is no doubt of its being a special and very important form.

All these Lizards are oviparous, laying cartilaginous-shelled eggs. These are often laid by Lizards which are kept in confinement. I do not know, however, of a single instance of their having hatched.

The method used by the boys of Capri for taking Lizards is also used by all boys here.

The Skinks are represented by only one species: the Ocellated Skink (*Chalcides ocellatus*, Forsk.).

This Skink is common, especially in arid and sandy places. Specimens from Lampedusa are said to be of a light colour, while those from Linosa are dark; both light and dark indivi-

duals are found in Malta; the latter are, however, the more common. I do not think that this difference of colour is due to age or sex, for I have seen both light and dark individuals of all dimensions and of both sexes.

Of our reptiles, this is the species which thrives best in confinement, where it also breeds most freely; it is viviparous. The specimens I kept in my vivaria never produced more than four at each birth.

[Some Chamaleons were imported about thirty or forty years ago, and set free in the gardens of the Jesuits College at St. Julian's, where they seem to have reproduced. I do not think, however, that this is a sufficient reason for us to include the species amongst our indigenous reptiles; moreover, having tried lately to procure a specimen, I was told by the gardener that he had not seen a single one for the last five or six years.]

The Snakes are represented by two species, one of which has a variety. These are: (1) the Dark-green Snake (*Zamenis gemonensis*); with its black variety (*Z. gemonensis* var. *carbonaria*, Bonap.); (2) the Leopard Snake (*Coluber leopardinus*, Bonap.).

The Dark-green Snake, or typical form, is pretty common in the fields. Much more common, however, is the second, namely, the black variety. According to Dr. Gulia, this last is very common on some hills of Gozo.

The Leopard Snake is pretty frequent, but by no means common like the foregoing. It seems to prefer dark and sheltered localities, so much so that it is often found in cellars and other subterranean localities, not only in villages but also in the towns.

Of the two species of Snakes the last is the best for keeping in a vivarium; the first does not seem to be susceptible of domestication. It generally refuses to take any food, and its vicious character renders it by no means a sympathetic pet.

Both species are oviparous, laying cartilaginous-shelled eggs. I have never seen the eggs laid by specimens in confinement.

[Giglioli found a specimen of the Cat-Snake (*Tarbophis vivax*) in Malta, and so Dr. Gulia includes the species with our reptiles, saying it is very rare. I do not think, however, that the finding of a single specimen entitles the species to form a part of our list; moreover, exotic individuals have been more than once introduced with imported hay, straw, &c.]

We come now to the Chelonians, which are represented by one species : the Loggerhead Turtle (*Thalassochelys caretta*, Linn.).

The Loggerhead Turtle is very common in our seas, and from August to November is taken in large numbers ; in spring it also reappears, and has been known during that season to lay its eggs on our unfrequented sandy beaches, especially at Gozo. It is largely used as an article of food by the majority of the population.

[Dr. Gulia includes three species of Tortoises amongst our Chelonians, namely, the *Testudo græca*, which he says has been naturalized in such a way that it cannot be excluded from amongst our indigenous fauna. To this he says can be added the *T. mauritanica* and the *T. marginata*, which are often imported from the north coast of Africa. Dr. Gulia adds that the last species is rather rare. As regards the *T. mauritanica* and the *T. marginata*, there is surely no need of proofs to show that they have no right to be included in our list. As regards the *T. græca*, it is only found in gardens, where it is generally kept as a pet, and I am sure that no one ever found in Malta a Tortoise in a wild state.]

Malta having only one Batrachian, the Painted Frog (*Discoglossus pictus*, Otth.), it might be also included in this list. This Frog is very common, and in some localities it is most abundant, being found in myriads. It lives both in fresh and brackish water. The most peculiar fact about this Frog is that while in other countries it is said to spawn several times from March to October, in Malta it seems to spawn during the other four months too.

The following are the local names for the reptiles of Malta :—

Turkish Gecko	= "Wizgha tad-diar."
Wall-Gecko	= "Wizgha."
Wall-Lizard	= "Gremxula."
Filfola Lizard	= "Gremxula ta Filfla."
Ocellated Skink	= "Xahmet l'art."
Dark-green Snake	= "Serp."
Leopard Snake	= "Lifgha."
Loggerhead Turtle	= "Feruna tal bahar."
Painted Frog	= "Zring."

Note.—Dr. Gulia's list, alluded to above, is included in his very interesting note which was communicated to the Ninth International Zoological Congress held at Monaco in 1913, entitled, "Uno sguardo alla Zoologia delle 'Isole Maltesi.' "

MIGRATION AND OTHER ORNITHOLOGICAL NOTES
FROM LOWESTOFT. (1914.)

By F. C. COOK.

WHEN walking in the fields near the church on June 9th my attention was drawn to the curious movements of a Common Whitethroat, which was fluttering and running along the ground as if wounded. Thinking this to be a ruse to attract me from the spot, I peered into the hedge from whence she had first flown, and discovered four young Whitethroats scarce able to fly, and from whom, by her movements, the bird had evidently intended to allure me.

June 12th.—Several Common Terns, with their young (which they were feeding), on the shore.

14th.—A flock of twenty to thirty Wild Geese were seen flying over the town to the north.

15th.—A large movement of Starlings was witnessed; all were going south in flocks containing from twelve to twenty birds; these flocks appeared to me to have been composed chiefly of young birds of the year.

18th.—A greater number of Lesser Terns appear to have nested at Benacre this year. Our search for the Common Tern nesting here was fruitless, although many of them stayed in the vicinity all the summer; they were evidently non-breeding birds. Young Lesser Terns and Ringed Plovers were seen at Benacre.

19th.—Many flocks of Starlings were making southward, as they were also on the 20th, 21st, and 22nd. On the 23rd, besides many flocks of Starlings going south, one flock was noted going north, flying at a great altitude. A Spotted Fly-catcher was seen on the Denes, and a Chiffchaff heard at Corton.

25th.—Starlings were again moving south, and several Ringed Plovers and Pied Wagtails were seen near the shore.

July 3rd.—I had the good fortune to observe a Spoonbill on

Breydon on this date, and had been watching it for some time through my glasses when it suddenly rose into the air with its legs hanging down as though something had attached itself to its foot (in all probability a crab) from whose grasp the much-surprised bird was endeavouring to rid itself. After wheeling around for several seconds it appeared to have shaken off its unwanted "hanger-on," for stretching its long legs straight out behind, it sailed off to another flat to resume its feeding with the more congenial companionship of a flock of Gulls.

15th.—Several Curlews were heard over the town at night.

26th.—An injured Black-headed Gull that has had the run of our garden for about six years captured and swallowed alive a young Sparrow. This Gull is also an adept at fly-catching; he will stand with head drawn in waiting for a fly to appear, when he at once darts out his head and is mostly successful in capturing the insect.

31st.—The cries of many Curlews and Dunlins were heard over the town at night.

August 10th.—A flock of ten Curlews were observed flying south along the shore during the afternoon; others were heard over the town at night, as they were also on the 11th.

14th.—Two Herons were seen going quite over the sea due east.

20th.—Three Wheatears, two Pied Wagtails, and about a dozen Lesser Terns had put in an appearance; flocks of Starlings were observed in the fields; two Whimbrel seen at Corton.

22nd.—The following migrants had arrived this morning: Many Stonechats and Wheatears, four Yellow and several Pied Wagtails, a number of Meadow-Pipits, four Common White-throats, a few Common and several Lesser Terns; a few Swifts were also seen. An immature female Ringed Plover was brought to me, having been taken in the vicinity of Smith's Knoll Lightship by one of our fishing boats on the 21st.

23rd.—Vast numbers of Swallows (mostly immature) and Martins were observed flying over the Denes in the evening; a few Swifts were also seen. Pied Flycatcher seen.

24th.—Four Common and a few Lesser Terns, fewer Stone-

chats and Wheatears, more Yellow and Pied Wagtails. Many Dunlins were heard passing over at night.

25th.—A Whinchat, one or two Willow-Wrens, a few Pied Wagtails, and two Lesser and a few Common Whitethroats had arrived. Still a few Wheatears and Stonechats to be seen. Sand-Martins and Swallows, and a few Common and Lesser Terns were noted going south. A great many Whimbrel were heard about the lighthouse at night, but none could be seen.

26th.—Three Yellow and several Pied Wagtails, a Lesser and two Common Whitethroats, and a few Wheatears and Pipits seen; also a Curlew and two Common Terns. With the addition of a Reed-Warbler, about the same number of birds were seen on the 27th.

29th.—At Benacre, nine Curlews were resting on the Denes, where there were also many Wheatears, one or two Whinchats, a few Stonechats, and a number of Yellow and Pied Wagtails. Two Dunlins and six Whimbrel were noted going south along the shore.

30th.—A fair increase of Wagtails and Pipits was noted; Wheatears and Whitethroats were seen in about the same numbers. Many Swallows and Martins were observed going south.

September 1st.—Quite a number of Wheatears and Stonechats had put in an appearance; two Whinchats and a Wry-neck were also seen. The numbers of Wagtails and Pipits had decreased.

2nd.—Wheatears and Stonechats were seen in smaller numbers; a few small lots of Yellow Wagtails were observed to come in from the north.

6th.—Many Wheatears had arrived; Stonechats and Pied Wagtails were observed in fair numbers; only one Yellow Wagtail was seen.

10th.—A few small flocks of Linnets had arrived; only one or two Wagtails seen; several Swallows and Martins were noted making southwards; about the same numbers of Stonechats and Wheatears were observed.

12th.—A Heron was seen making out to sea eastwards, and a Kestrel was noted going south along the shore. Sky-Larks, Starlings, and Linnets were sprinkled over the Denes in small

flocks; other birds observed were a few Meadow-Pipits and Pied Wagtails, Wheatears, and Greenfinches. Two Swifts were seen on the 14th.

17th.—A vast number of House-Martins, with a few Swallows, were observed making southwards; many of both species were also seen collected on telegraph wires. A few Wheatears and a Lesser Whitethroat were seen. Meadow-Pipits and Linnets were noted in fair numbers; and a few Common Terns, Stonechats, and Yellow Buntings were also seen.

19th.—Two Reed-Buntings, several Sky-Larks and Starlings were noted as fresh arrivals; a considerable increase was also noted in the number of Hedge-Sparrows. Swallows and House-Martins were seen in large numbers, and many Common Terns were noted along the shore and also at the harbour-mouth.

21st.—Several more Reed-Buntings had put in an appearance; a few Meadow-Pipits, Linnets, Sky-Larks, and Stonechats were seen, also two Wheatears, several Swallows and House-Martins, and a Marsh-Tit. A few Lesser Black-backed Gulls were noted resting on the Denes. A large flock of Starlings were seen flying south, and a Dunlin was noted going north.

23rd.—Many flocks of House-Sparrows, a few small lots of Meadow-Pipits, four flocks of Starlings, and a few Linnets were observed passing along southwards. House-Sparrows, Larks, and a few Linnets were also noted going north. A few Reed-Buntings, several Goldcrests, and two Cole Tits were also seen.

24th.—Five Kestrels were seen on the "marrams" together. Two flocks of Starlings, a flock of House-Sparrows, and a few odd lots of Linnets noted going north. A number of Yellow Buntings had put in an appearance; other birds observed were a few Reed-Buntings, a Turtle-Dove, a Common Whitethroat, and several Goldcrests and Pied Wagtails.

28th.—The southward movement comprised the following species: Several lots of Linnets, Starlings, a flock of Tree-Sparrows, and several House-Sparrows. Going north were a number of Greenfinches and Linnets. A fair number of Reed-Buntings, Starlings, a few Pied Wagtails and Larks on the Denes. Many House-Sparrows and a few Swallows were also seen.

30th.—Greenfinches, Linnets, Tree-Sparrows, and Larks were moving southwards; several House-Sparrows were heard among the migrating flocks of Linnets. A Ring-Ousel was seen on the Denes.

October 1st.—Moving south were numbers Linnets, a few small lots of Greenfinches, a flock of Larks, odd lots of Meadow-Pipits, and a few flocks of Tree and House-Sparrows; while going north were noted a flock of Starlings and one or two flocks of Linnets and Greenfinches. A Greenland Wheatear was observed, also a few Pied Wagtails, several Goldcrests, Cole Tits, and a number of Reed-Buntings. Two Sand-Martins were noted going south.

2nd.—Four flocks of Mistle-Thrushes observed going north; one flock contained fifteen birds. Other species noted passing northwards were several lots of Linnets and a few Greenfinches. Linnets, Greenfinches, Tree and House-Sparrows were all seen going south. Still a few Reed-Buntings; several Swallows and House-Martins seen.

I was away from the town from this date until the 11th.

11th.—Three large flocks of Rooks were seen to arrive in from over the sea, flying very high. Passing south were noted a few flocks of Chaffinches and Linnets; many Gulls of various species were also working southwards. Many Goldcrests were seen, also three Rock-Pipits.

12th.—A great increase in the number of Goldcrests and Common Wrens was noticed. A Brambling was heard going south with a flock of Linnets; Chaffinches and Greenfinches were also going south, while going north were Tree-Sparrows, Greenfinches and Linnets.

14th.—A fair migration of Mistle-Thrushes was observed; several flocks were passing both north and south. Other birds passing in a southerly direction were a flock of Starlings, five Hooded Crows, two Swallows, two Bullfinches, two Bramblings, many Linnets, a few flocks of Tree-Sparrows, a few Greenfinches and Chaffinches, and a few odd lots of Larks. A small flock of Larks and another of Starlings arrived in from sea. The northward movement consisted of a few Linnets and Starlings. Still several Goldcrests.

16th.—I was working the tide-mark with the hope of finding

a few birds washed ashore during the rough easterly wind that prevailed at the time, when I came across a Razorbill with its breast black, sitting by the edge of the water vigorously preening its feathers; I ran and endeavoured to capture it before it could take to the water, but it was too smart for me, as with harsh croaks it shuffled back into the sea, and by repeatedly diving soon placed a fair stretch of water between itself and the shore. I was for a time greatly puzzled about this bird, and wondered in my own mind whether I had made the acquaintance of a variety of Razorbill hitherto unrecorded, but the entry of the 17th will explain. A Jackdaw was the only bird washed ashore. A great arrival of Robins was noted, and fights between the resident birds and the newcomers were general; I could not detect the Continental form among these Redbreasts. Flocks of Linnets, Greenfinches and Chaffinches were passing both north and south; some Goldfinches were heard among the flocks of Linnets that were going south.

17th.—I walked from Corton almost to Gorleston by the beach in company with Mr. Hunt. The tide-mark was strewn with a thick tar-like substance, and we found in all eight Razorbills and a Guillemot cast up from the sea, so besmeared with this black viscous matter that not one feather could be separated from another, and in only one example could any trace of the white breast be seen. We also saw another live example sitting on the shore, madly endeavouring to free itself from the sticky mess. Mr. A. H. Patterson, writing in the 'Eastern Daily Press' on this subject, says:—"I suspect some unfortunate submarine or torpedo-destroyer had been sunk, and the petrol and other stuff of a like character had, after explosion, risen to the surface." I imagine this is a most satisfactory explanation as to the presence of this "tar" that had caused such mortality among the diving birds. The following birds were found cast up along the shore, none of which I might state had any trace of the tar-like matter on their feathers: two Fulmar Petrels, two Rooks, a Jackdaw, two Redwings, a Song-Thrush, two Starlings, and a Herring-Gull, and a Lesser Black-back.

20th.—The coastal migration was very slight, only a flock of Starlings were seen going north, and a few Linnets moving south. I disturbed a flock of about a dozen Blackbirds, mostly

young males, from a patch of burnt furze* ; they had evidently arrived quite recently. Fair numbers of Robins and Goldcrests are still to be seen ; among the Robins I was able to identify at least three of the lighter Continental form ; these birds are extremely shy, and skulk in the same manner as do the Blue-throated Warblers. Mr. Patterson, writing from Yarmouth under this date, remarks :—“ What a ‘body’ of Redbreasts must have arrived last night (19th) ; our little park swarms with the little light red fellows. I picked one up dead near telegraph wires close to the beach, and gave it to my Kestrels with a dead hen Blackbird.”

21st.—During a short walk along the beach near the harbour I saw six more “tarry” Razorbills and a Guillemot ; a Redwing, and the wings and clean-picked sternum of a Rook were also seen on the tide-mark. Redwings are to be heard passing over the town almost every night.

22nd.—Several flocks of Larks, a large flock of Starlings, and a few Linnets and Chaffinches were noted going south. A great muster of Rooks, Jackdaws and Hooded Crows were to be seen in the coastal meadows. A Hooded Crow was seen attempting to bully a Kestrel ; the Crow was very much in earnest, but the Hawk merely glided aside at each stroke, and appeared to take things very calmly. One or two Continental Robins were observed. The following other birds were seen in fair numbers :—Blackbirds, Robins, Song-Thrushes, Yellow Buntings, Tree-Sparrows and Goldcrests ; a few Great and Blue Tits were also seen.

23rd.—Six Shore-Larks had put in an appearance on the Denes. A movement of Larks and Starlings of considerable dimensions took place ; the Larks were skimming along but a few inches from the ground, and the Starlings were flying very slowly, as the wind was very strong from the south ; both species were travelling in a southerly direction. A large number of Linnets, a flock of Greenfinches, and a few small lots of Chaffinches were noted going south, as were also a considerable number of Greater Black-blacked, Herring and Black-headed

* Mr. Patterson has noticed dead and half-roasted *Nemoralis* Snails and dried Lizards among the blackened stumps and ashes of burnt furze : probably these molluscs had attracted the birds.

Gulls. Robins and Blackbirds had decreased in numbers. I watched two Finches, of a species I was unable to determine, fly direct out to sea until out of range of my glasses. Still a number of Rooks, Hooded Crows and Starlings in the meadows; a large number of Yellow Buntings and a Wheatear seen.

24th.—A large southward movement of House-Sparrows was observed just at daybreak; many Gulls were also moving south. A Greenland Wheatear and two Rock-Pipits seen. Five tarry Razorbills and two Guillemots were found on the beach at Pakefield.

25th.—The following species were observed travelling southwards:—Numbers of Linnets, Greenfinches, a few Chaffinches and Tree-Sparrows, a few Larks and Starlings, a flock of Song-Thrushes and a flock of Lapwings, three Bramblings, and a few Meadow-Pipits. A small company of Rooks and a flock of Larks arrived in from sea. Linnets, Starlings and Song-Thrushes were noted going north. Several Reed and Yellow Buntings on Denes. A Chiffchaff was seen and heard singing.

28th.—Six Shore-Larks were seen. A Heron was observed making southwards. Several large flocks of Rooks, Jackdaws and Hooded Crows were coasting south, as were also Yellow Buntings, many Tree-Sparrows, a few Meadow-Pipits, many Linnets, and a few Greenfinches and Sky-Larks.

November 1st.—Six more Shore-Larks and three Snow-Buntings were noted as fresh arrivals. Several Lesser Black-backed and many other Gulls seen. An immature Herring-Gull was seen flying over the town with a long piece of string hanging from its mandibles; this bird may have been the victim of one of the foul jokes often perpetrated by the idlers that frequent the fish wharf, one of which is that of casting into the harbour a piece of string to each end of which is fastened fish offal; it invariably happens that two hungry Gulls will seize and swallow the connected baits at once, and fly off with the string holding them together.

On the nights of the 2nd and 3rd Lapwings and Redwings were heard passing over the town.

6th.—A considerable southward movement was witnessed, and the flocks comprised the following species:—Rooks, Hooded Crows, Yellow Buntings, Meadow-Pipits, Sky-Larks, Starlings,

Linnets, Greenfinches, Chaffinches, Tree-Sparrows and Mistle-Thrushes. On the Denes were noted a Shore-Lark, three Snow-Buntings, a Rock-Pipit, Lesser Black-backed and many other Gulls, a flock of Yellow Buntings, and several Goldcrests.

7th.—At Benacre. On the marshes were a number of Wigeon, a few Teal, several Common Snipe, many Lapwings, a Heron, and a Short-eared Owl; in a thick reed-bed were seen three Bearded Tits and a number of Reed-Buntings. On the Denes was a vast concourse of Rooks and Jackdaws (we estimated their numbers as over a thousand) which, as darkness came on, flew to the trees by the edge of the broad to roost; this appears to be a general roosting-place in autumn for the Rooks and Jackdaws of the district, for, as we watched, large flocks were continually arriving from all quarters, and the chattering as new flocks arrived was almost deafening. Mr. Hunt informs me that he has witnessed this mustering of Corvines at this spot often before.

11th.—A big movement of Greenfinches, Linnets and Chaffinches to the south was noted; a few Starlings also going south. A flock of about a dozen Shore-Larks was seen on the south Denes.

A Purple Sandpiper was seen on the 13th.

18th.—A flock of Rooks and Jackdaws was seen to arrive in from sea. Curlews and a number of other waders were heard passing over the town at night; Lapwings and Redwings have been heard passing over on several nights lately.

21st.—Six Shore-Larks and a flock of about twenty Snow-Buntings were observed on the Denes.

December 20th.—A Lesser Spotted Woodpecker was seen in a lane at Gunton. This is the first time this species has come under my notice in this district, although Mr. Hunt has on one or two occasions observed it at Pakefield. A large flock of Wood-Pigeons was seen passing south.

SOME EXPERIMENTS ON COLOUR-CHANGE IN THE TENCH.

By H. N. MILLIGAN, F.Z.S.

It is well known that the colour of the Common Tench (*Tinca vulgaris*) adapts itself to the surroundings in which the animal lives,* but a short account of seven experiments on colour-changes in this fish may perhaps be of interest. The first two experiments were involuntary ones.

1. Two healthy female Tench, each of about six inches in length, had been living in an aquarium, the floor of which was covered with dark brown pebbles and the back with dark brown rocks. The fishes were of a dark bronze-green colour, with their fins tinged with green and their irises of a deep coppery red; and this colouration had not varied, so far as I could see, or at all events had varied little, during the whole of the time (more than two months) they had been in the aquarium. At 11 a.m. on February 26th, however, they were removed to a second aquarium, which was in a somewhat lighter place opposite to a window, containing whitish pebbles and with a back of newly-made rockwork in great part composed of white cement, against which the dark green bodies of the fishes stood out conspicuously. At 9.30 a.m. on the next day my attention was drawn by another person to the fact that the fishes had undergone a striking change of colour. Their bodies were now of a pale yellowish colour, with only a very faint tinge of green, which gave them a sickly appearance, their fins being almost colourless and their irises orange. The change had certainly brought their colour more into harmony with the general colour of their background of pebble and rockwork. The aquarium was a comparatively small one, measuring two and a half feet in length and one and a half feet from back to front, and the two fishes could therefore

* See, for example, 'A History of Scandinavian Fishes,' Part 2, p. 750, of Fries, Erkström & Sundevall, second edition of Smitt.

be detected without difficulty; but it seems quite probable that if they had been in a larger aquarium they might have been entirely overlooked in a cursory glance. It would have been interesting to observe whether the fishes would have changed to their original colour if they had been taken from aquarium 2 and put into aquarium 1, but unfortunately this aquarium had been cleaned out and the pebbles removed in the meantime.

2. In aquarium 2 the fishes remained until April 6th, *i. e.* for five and a half weeks. During this time the whitish pebbles and rocks of this aquarium had become somewhat darker in colour owing to the effects of light and the growth of green and brownish vegetable matter. I believe, though it is very difficult to be quite certain in such a case, that the fishes also had become a little darker in colour, their green tinge being more pronounced.

3. I now resolved to observe the effects of placing the fishes in a third aquarium whose bottom and three sides were of dark blue slate, the top of the aquarium being almost wholly covered with a wooden board to exclude light, and the glass front turned away from the window. In aquarium 3 the two fishes were placed at 10.10 a.m. on April 6th. At 10.50 I looked at them and saw at once that they were unmistakably darker in colour. At 12.5 I examined them again, removing them rapidly from the dark aquarium 3 to a small glass tank and carrying them to the window in order to do so. Both fishes were now dark green, perhaps of a darker green than they had been when I took them from aquarium 1, their irises being coppery red and their fins greenish, but the beautiful bronze tint of the body was now almost absent.

4. I allowed the two Tench to remain in aquarium 3 until the morning of the 8th. At 12.35 I removed one of them to a white enamelled dish, containing about a gallon of water, placed before a window in a fairly light spot. A distinct change could be observed in this fish at 1.30, and by 2.30 the change back to the sickly pale yellow colour had been accomplished. The individual left in the dark aquarium 3 was, of course, unaltered. When, at about 4.15, the two fishes were put together in the little glass tank and carried to the window, the contrast between the dark green individual and the pale yellow one was very striking.

5. Both fishes were now put back into the dark aquarium 3, and on the following morning (April 9th) both were of the deep green colour.

I thought that the above-described experiments deserved to be recorded because, though not perhaps of an original nature, and relating to only two individuals, they were of themselves sufficiently definite to allow of certain conclusions being drawn, and might therefore be acceptable as additional evidence that the Tench can, to a certain extent, adapt its colouration to its surroundings, and that it can be made to change at will.

6. In 'A History of Scandinavian Fishes,' p. 750, it is remarked of the Tench that in clear water ". the whole body is yellowish green on a golden ground, with fine, golden dots, at the tip of each scale When it is found in the forest tarns, where the water is generally very dark, the entire upper part of the body is black, as though dipped in ink, only the belly being somewhat lighter." As the Tench in aquarium 3, although dark green, and darker on the top of the head and along the middle line of the back than on the under parts, were certainly never so dark "as though dipped in ink," I covered up the aquarium 3, with the two Tench in it, in such a way that all light was excluded, and left it for a day. The Tench seemed to me at the end of this time to be no darker than they had been at any time in aquarium 3. Experiments on these two Tench seem to show that there is a lightness of yellow and a darkness of green which the fishes cannot exceed, and that two hours is sufficient time to enable them to change from one extreme to the other.

7. I wished now to observe whether any effects would be produced by taking a Tench from aquarium 3 and putting it into a small aquarium, which had four sides of glass, and then surrounding the aquarium with bright red cloth, through which, for a day, a strong light passed from a window. The Tench did not change from its dark green colour.

THE RELATION OF THE OYSTERCATCHER TO ITS NATURAL ENVIRONMENT.

By J. M. DEWAR, M.D.

(Continued from p. 291.)

IV.—THE SUMMER ENVIRONMENT.

1. General Considerations.—The area which came under observation as a nesting habitat consisted of Loch Tummel; that portion of the valley of the River Tummel extending from Faskally to the junction of Tummel and Tay at Ballinluig; the Vale of Atholl between the villages of Blair and Killiecrankie; and the lower part of Glen Fender. Only the south shore and the foot of Loch Tummel were systematically observed.

The rocks of the area belong to the metamorphic series, and consist mainly of sedimentary limestones and schists, together with numerous igneous sills scattered all through the various schists.

The area forms part of a "land of ridges and broad valleys," the weather conditions being of the Atlantic type. From Loch Tummel to the junction of the Tummel and the Garry, the gradient is steep, and there are hardly any deposits of alluvium. At the junction is a series of terraces, covered with gravel and cut out of a thick deposit of boulder clay. Similar conditions prevail as far as Pitlochry. From this point to Ballinluig the gradient is slight, and the river has denuded the bottom of the ancient glacial lake, forming a large plain of alluvium. Between Blair and Killiecrankie the slope is considerable, but less than in higher parts of the Garry. Here large alluvial terraces have been formed. The hill-streams are mostly torrential in character, and deposit little alluvium. The lower portion of Strath Tummel is well wooded, while natural birch is general up to about 300 metres. The distribution of the human population is determined by the boulder clay deposits which favour arable

cultivation, and maintain a larger number of persons. Between Blair and Killiecrankie the drifts are a mixture of moraines and boulder clay. This area is occupied by numerous farms. On the north side of Loch Tummel there is an important deposit of boulder clay, which is largely farmed. The left bank of the Tummel below Faskally has large deposits of boulder clay, and is the chief area of arable cultivation in the valley. The alluvial plains of the Tummel lie more as pasture than under cultivation. Elsewhere there is a cold inferior soil suitable only for sheep pasture.

The meteorological data available come from Ochertyre, Central Perthshire (90 metres above M. S. L.). The mean annual temperature is $8.16^\circ \pm 4.06^\circ$ C.; the average rainfall for the year being 1.05 metres on 192 days (1871-1905). The mean monthly temperature and rainfall for April, May, and June are here given in the form of a table for Leith (sea-beach habitat) and Ochertyre (*quasi* river valley habitat), for the sake of comparison.

Table 1, showing Average Monthly Temperature and Rainfall for April, May, and June at Leith and Ochertyre (1871-1905).

TEMPERATURE.	APRIL.	MAY.	JUNE.
Ochertyre...	$7.13^\circ \pm 4.56^\circ$	$10.05^\circ \pm 5.11^\circ$	$13.44^\circ \pm 5.11^\circ$
Leith	$7.31^\circ \pm 4.16^\circ$	$10.05^\circ \pm 4.28^\circ$	$13.28^\circ \pm 4.34^\circ$
RAINFALL.			
Ochertyre...	0.058 m.	0.060 m.	0.076 m.
Leith	0.036 m.	0.042 m.	0.049 m.

The breeding stations within the area examined fall into three distinct habitats—a hill-stream, a river valley, and a lake beach habitat. The Fender Burn is representative of the first, the Rivers Garry and Tummel of the second, and Loch Tummel of the third. A strong similarity exists among all the stations of each habitat, variability of the factors being much less pronounced than in the winter environment.

2. *Hill-stream Habitat.*—A general survey of the whole area made in 1909 showed that Oystercatchers do not nest along the

hill-streams in this locality. The occupation of Glen Fender appears to be due to a circumstance not forming an integral part of the environment of a hill-stream. The breeding territories extend along the glen for a distance of two kilometres from the top of the terminal gorge at 230 metres up to the 305 metres contour line. Within this course the stream is of small size and flows with a moderate gradient. Areas of shingle are few in number, and possibly too small to be serviceable for nesting purposes. The south bank, lying between the stream and the public road, has an average breadth of 450 metres, and lies mostly below the 305 metres line. It is a terrace, a steep slope joining the upper and lower levels. More than twelve years ago the south bank was densely wooded. The trees were felled, and the roots left in the ground to bleach. As grass grew, sheep were turned down. The conditions have remained unaltered to the present time. The ground is permanently wet in places. There is a moderate supply of Earthworms, and a fairly abundant supply of tipulid and coleopterous larvæ. The northern slopes of the glen have a thick deposit of boulder clay, and are cultivated below the 305 metres level. The arable land forms the general or distant feeding-ground, and provides a large part of the Earthworms required to feed the young. The rest of the glen is under heather and grass. Three pairs are cantoned along the south bank, which forms the local feeding-ground. The nesting-sites have not been seen. The tree-stumps are used as watchtowers, and for the sunning reaction. The roots, now of a light grey colour, form an important element in the crouching response of the chicks. The terraced nature of the ground is used successfully by both young and old in evading detection. The area is little disturbed.

3. *Lake-beach Habitat*.—Loch Tummel is a deep rock basin, 4.4 kilometres long. The shore descends steeply into the water, and is marked by a narrow fringe of angular boulders, resting on the mud substratum. At the east end, or foot, of the loch there is a storm-beach of light grey shingle, grading northwards into a fine sand-beach, and running upwards into the true lake margin of angular boulders. The storm-beach has a breadth of about 45 metres. A strip of uneven grass-grown ground, with a few trees, separates the beach from an alluvial plain which is

under cultivation. On the south shore of the loch, the Lochan a Chait, Frenich, and Cragan Dubh Burns have deposited cones of alluvium, in that order from east to west. The cones are margined by light grey shingle on the east and north aspects. Towards the west the shingle thins out into a scanty fine gravel, resting on the mud substratum. The shingle rarely exceeds 25 metres in breadth, and mostly is much narrower. The eastern cone forms an old enclosed pasture, and shows very well terracing into two levels. The large Frenich cone is under arable cultivation, which, however, leaves a broad strip of turf thinly planted with trees along its water margin. The western cone is very small, and consists entirely of natural turf, thinly sown with alders. Small sand-beaches are intercalated in the shingle at places. The water is fairly deep on the east side of the cones, shallow on the west, where mud-banks are forming which expose at low water, and become then, like the mud shore, more or less grass-grown. The true lake margin is not evident on the beaches of the cones. The hillside behind the southern shore shows heather and rock grading into natural birch and alder wood towards the west. The north bank of the loch is largely under arable cultivation. Within the area examined, nesting is confined to the storm-beach and the beaches of the alluvial cones. The ground behind the storm-beach and the turfed portions of the alluvial cones form the local feeding-grounds. The arable land at Frenich, Duntanlich, and on the north side of the loch form the general or distant feeding-grounds. From these, large quantities of Earthworms are brought to the young. The local feeding-grounds provide tipulid and coleopterous larvæ in plenty. The true lake margin has a large invertebrate population, but the beaches of the alluvial cones are deficient in this respect. The open spaces in the woods also contribute supplies. The whole of the breeding territories and local feeding-grounds lie considerably below the 152 metres contour line. A large sand-bank at the head of the loch, and a boulder area on the north shore, near the exit of the loch, are used every year by the birds that have failed to breed as places of assembly for bathing, sunning, and other activities.

4. *River-valley Habitat.*—A. *The River Garry.* The river in the four kilometres of its course between Blair and Killiecrankie

falls about 15 metres from an elevation of about 120 metres at the former place, and describes two major curves bordering extensive alluvial plains. The beds of shingle are fairly large, and composed of a light grey, water-worn stone of moderate size. The Strath is well farmed and populous. The river side is easy of access to the public. The resident stock has been much harassed and rarely succeeds in breeding on the shingle. The birds have taken to nesting away from the river on naked moraines, other collections of stones, and, in at least one instance, on the ballast of the railway track.* All the breeding territories and local feeding-grounds lie below the 152 metres contour line.

B. *The River Tummel.* Between Faskally and Ballinluig the Tummel is a pool, rapids river of considerable size. Above Pitlochry it flows through a narrow glen, ending in a rocky gorge. At Faskally there are broad river terraces, fringed by a bank of shingle, composed of light grey stones of moderate size, and rising at least one metre above summer water-level. The Faskally terraces show two main levels, an upper and a lower, and are in pasture. At Clunie there is a crescentic band of shingle backed by a steep wooded slope. From Pitlochry to Ballinluig the gradient is gentle (about 1 in 400), and the river has formed "a large flat of alluvium." The plain has been cut by the river into cones. These are fringed with light grey shingle, which spreads out into larger areas, or banks below the cones, the size of the areas increasing from above downwards, and culminating in the relatively vast area of shingle running alongside Logierait Wood, on the right bank of the river. The cones are entirely in pasture, or the basal portions are cultivated. The hill slopes on the left bank, being covered largely with boulder clay and having a south-western exposure, are mainly under cultivation. The slopes on the right bank are little farmed, being mostly in natural grass, or, as in the lower reaches, densely planted with wood.

Nine stations in all were recognized and kept under observation between Faskally and Ballinluig. They have not, however, an equal value for population, the numbers varying from one

* This happened above Blair.

pair to ten or more pairs in each station. Denoted by the nearest place-name on the map, they are, from above downwards, Faskally, Clunie, Pitlochry, Black Spout, Dunavourd, Haugh, Moulinearn, Logierait Wood, and Ballinluig. (Ballinluig Island is here included in the Logierait station.)

Faskally has already been described. It is quite a typically favourable river station, having a fairly large and high shingle-bed, well secured from intrusion; a terraced local feeding-ground in pasture; and general or distant feeding-grounds which, however, are rather far away. The Clunie area is much disturbed, and is backed directly by a steep, wooded bank. No young birds have been seen here. The Pitlochry station is the first of the large areas, the extensive and high bank of shingle being centred by a small grassy island with a few pine trees. The cone is beautifully terraced, and is in pasture. It now forms a public park. No birds breed here. The Black Spout and Dunavourd areas are similar to Faskally in all respects, except that general feeding-grounds are not far away. Dunavourd ceased to be occupied when the pasture of the local feeding-ground was ploughed. The Haugh station, though very large, has a simple composition. There is an extensive and high bank of shingle containing a grassy island. The alluvial flat has considerable extent, is obscurely terraced. Most of it is pasture, but portions farthest from the river are under cultivation. The area is much disturbed by the human population. Moulinearn and Logierait are large stations with diverse features. A more intensive examination will probably break them up into several distinctive areas. The upper part of the Moulinearn margin is composed of large stones having more an appearance of moraine than of river shingle. It grades into a belt of true shingle, which spreads out into a large area of shingle below the alluvial cone. The latter is mainly in pasture, distinctly terraced, and marked with clumps of whins, shallow irregular mud-pits and sand-bunkers. The basal part is cultivated, and there is a back-water with wide, muddy margins. The Logierait area measures over 1600 metres in length by 400 metres in breadth. The upper part is a terraced alluvial cone in pasture with a shingle fringe of considerable size. At the extreme north-western corner, what appears to be morainic material, similar to that found at

Moulinearn, is occupied by a small settlement. Below the alluvial cone the shingle forms a broad belt, backed by the steep wooded slope of Logierait, and margined by three wooded islands. These islands form local feeding-grounds. The uppermost is a dense, natural wood, with wet sand-gullies and pot-holes gouged out of the substratum by the winter floods. The lower islands are flat, grass-grown and artificially wooded. The Ballinluig area presents a sequence of appearances very similar to that of Moulinearn. It also contains a plateau planted with pines and having a turf layer on a clay substratum. This station is of moderate size, and is subject to considerable disturbance.

The whole of the breeding territories and local feeding-grounds lie between 60 and 105 metres above sea-level. The 76 metres contour line crosses the river at the upper part of the Haugh area.

Nesting is mostly confined to the shingle. At Moulinearn and Ballinluig, however, more nests are seen on mud and turf, due in the former place probably to carting of stones, and in the latter to other human interference. Nesting far from the river is rare. One instance came under notice. Towards the end of June a chick, a few days old, was seen on the hillside above Dunfallandy House. The chick must have belonged to a second, or possibly a third, laying.

The shingle shows few living invertebrate forms. At the time of the hatch, and possibly at other times, large quantities of Stonefly nymphs are to be found under stones at the water margin. These nymphs are fed extensively to the young during the early days. The local feeding-grounds, where in pasture and open to examination, are rich in tipulid and coleopterous larvæ. The bulk of the worms comes from the arable land. Only the upper Logierait wooded island was examined. The substratum is sandy. Where the sand was dry, the nature of the food supply observed to be got by the birds could not be determined. The wet sand of the gullies and pot-holes contained an abundance of worms of sand and silt bottom formation.

(To be continued.)

A CATALOGUE OF THE LAND AND FRESHWATER MOLLUSCA OF SUSSEX.

By E. W. SWANTON.

(Member of the Conchological Society; Curator of the Educational Museum,
Haslemere.)

(Continued from p. 314.)

Helix aspersa, Müller.—Generally distributed. Mr. J. W. Lewis Abbott's discovery of a number of very large shells (represented both by whole and broken ones) under about three feet of midden material in primeval refuse-heaps at Hastings affords presumptive evidence that it was an article of food in prehistoric times. Mr. J. P. Johnson has recorded it from a neolithic rain-wash at Brighton. Mr. R. Miller Christy found, in 1878, "assuredly pre-Roman specimens in association with *Clausilia rolphii*, *Cyclostoma elegans*, and *Helix nemoralis*, buried beneath the loose earth, filling up the pits within the Roman Camp at Cissbury." Mr. Ernest Robinson found (1907) hundreds of shells between the large flints in some of the prehistoric pits in the neighbourhood of Saddlescombe. He came to the conclusion that they reached those positions when hibernating. Mr. J. W. L. Abbott found albino specimens with shells of normal coloration (a rare condition) in St. Margaret's Road, St. Leonards-on-Sea. Small forms have been taken by Mr. C. H. Morris at Lewes, by Mr. R. M. Christy at Brighton, and by Mr. B. M. Oakshott at Worthing.

Var. *conoidea*, Picard.—Near Lewes (Jenner); Downs, Eastbourne (Rev. S. S. Pearce); tolerably common on a stone wall facing the sea at Littlehampton (W. C. Atkinson); Worthing (J. H. James).

Var. *globosa*, Picard.—Near Lewes (J. Jenner).

Var. *unicolor*, Moquin-Tandon.—Worthing (B. M. Oakshott); Lancing (F. Rhodes).

The subvar. *grisea* has been observed by Mr. E. F. Becher at Clayton.

Var. *fasciata*, Picard.—Lancing (F. Rhodes); with B. F. 12300 at West Stoke (Rev. W. A. Shaw).

Var. *solidissima*, Paulucci.—“A dull-coloured and extremely thick-shelled variety living on the South Downs in rabbit burrows, R. M. Christy” (Taylor, ‘Monograph,’ iii. 257).

Var. *albofasciata*, Jeffreys.—Worthing (A. Loydell); Littlehampton (D. Taylor); Lancing and Sompting (E. W. S.).

The subvar. *albescens* has been taken at Littlehampton by the Rev. D. McMurtrie; and the subvar. *puncticulata* at Winchelsea (Rufford Collection, Hastings Museum).

Var. *exalbida*, Menke.—Lewes (Morris and Unwin); near the mouth of the Cuckmere (Jenner); under a wall near Meads, Eastbourne (Rev. S. S. Pearce); Seaford, also a colony at Newhaven (Jenner); St. Leonards-on-Sea (J. W. L. Abbott); with var. *conoidea* at Littlehampton (W. C. Atkinson); Sompting (R. M. Christy); Worthing (B. M. Oakshott); Heyshott, hedges near the Down (E. W. S.).

The subvar. *virescens* was found by Mr. Borrer at Cowfold.

Var. *zonata*, Moquin-Tandon.—Near Lewes (J. H. A. Jenner and R. D. Darbshire); Worthing (B. M. Oakshott); Wilmington, near Eastbourne (W. E. Brady).

Var. *tenuior*, Shuttleworth.—Worthing (A. Loydell).

Var. *undulata*, Moquin-Tandon.—Near Lewes (Jenner); Worthing (T. D. A. Cockerell); Littlehampton (Rev. D. McMurtrie); Winchelsea (Rufford Collection, Hastings Museum).

Var. *flammea*, Picard.—Near Lewes (Jenner); Winchelsea (Rufford Collection).

Monst. *sinistra*, Féruccac.—“Two dead but immature examples found laid together in a garden at Lewes, May, 1897, C. H. Morris” (Taylor, ‘Monograph,’ iii. 267). “A sportsman once asked me if *H. aspersa* turned the wrong way was unusual, as he had seen two by some burrows whilst rabbit shooting near our West Surrey border!” (Rev. W. A. Shaw, *in litt.*, November, 1911).

Monst. *cornucopiae*, Gmelin.—The Rev. W. A. Shaw reports a subscalariform example from Little Common, Bexhill.

H. pomatia, Linné.—Christopher Merret refers to the occur-

rence of this species in Sussex in his 'Pinax rerum naturalium Britannicarum,' 1667; the reference is the earliest that I have discovered concerning the molluscan fauna of the county. We have evidence that it was esteemed as an article of diet by the primeval inhabitants of the Downs; the Rev. W. A. Shaw informs me that shells were found in British middens on Stoke Clump in 1910.

It is doubtful whether it exists in Sussex at the present time. Allusion has already been made to attempts at reintroduction by zealous conchologists (pp. 178, 179).

H. nemoralis, Linné.—Generally distributed. Mr. F. Dixon has recorded it from post-Pliocene beds at Bracklesham Bay, the Rev. W. A. Shaw from a post-Pliocene deposit near West Stoke, and Mr. J. P. Johnson has found it in Pleistocene beds exposed at low tide on the foreshore at West Wittering. Holocene records are the "mud deposit" at Selsey, 1891, Alfred Bell; beneath loose earth filling up the pits in the ancient Roman camp at Cissbury, Mount Caburn, and Seaford (General Pitt Rivers); cultivation balks on the Downs near Brighton (H. Toms); and near the base of a neolithic chalky rain-wash overlying the Palæolithic rubble-drift to the east of Brighton (J. P. Johnson). (Its association with archæological remains has been commented upon in the first part of this paper, pp. 179-181.)

Large shells (var. *major*) have been taken by Messrs. Jenner and Morris at Lewes, and minor forms have been taken in the same neighbourhood by the former observer.

Var. *acuminata*, Baudon (= var. *conoidea* Clessin).—Common on Brighton Downs (Rev. J. W. Horsley); Lewes (J. H. A. Jenner).

Var. *rubella*, Moquin-Tandon.—Lewes (T. S. Hillman); Pevensey (T. D. A. Cockerell); between Robertsbridge and Hurst Green (T. D. A. Cockerell); Littlehampton (D. Taylor); Graffham, near Petworth (D. Taylor); Charlton Forest (E. W. S.); about Sompting and Lancing (E. W. S.).

Var. *libellula*, Risso.—Lewes (T. S. Hillman and J. H. A. Jenner); Littlehampton and Burpham (D. Taylor); Buckhurst Park (E. W. S.); Ore, Hastings (A. J. Alletsee).

Subvar. *flava*.—Charlton Forest (E. W. S.).

Var. *albina*, Moquin-Tandon.—Lewes (C. H. Morris).

Var. *castanea*, Moquin-Tandon.—Lewes (J. H. A. Jenner); Littlehampton and Northchapel (D. Taylor).

The fawn-coloured subvar. *petiveria* and the subvar. *fulvo-cincta* (described as “very pale fulvous or pinkish yellow”) have been found near Lewes by Mr. C. H. Morris.

Var. *fasciata*, Moquin-Tandon.—Heyshott and Graffham (D. Taylor).

Var. *hyalozonata*, Taylor.—Lewes (J. H. A. Jenner); Charlton Forest (D. Taylor).

Var. *roseolabiata*, Kobelt.—Near Lewes (J. H. A. Jenner).

Var. *albilabris*, Dumont & Mortillet (= *albolabiata*, von Mart.). Ranscombe, Lewes (T. S. Hillman); Ratham (W. Jeffery); Lavant (Rev. W. A. Shaw).

Var. *bimarginata*, Moquin-Tandon.—Lewes (Jenner).

Var. *undulata*, Gentiluomo.—A form approaching this variety has been taken by Mr. Douglas Taylor in Charlton Forest.

Var. *fascialba*, Picard (= *leucozona*, Taylor).—Lewes (C. H. Morris); Charlton Forest (D. Taylor).

Var. *conica*, Pascal.—On the Race Hill, Lewes (Jenner); common on Brighton Downs (Rev. J. W. Horsley).

Var. *studeria*, Moquin-Tandon.

The subvar. *purpureo-tincta*, “very pale purplish like var. *pallida* of *H. hortensis*,” has been found near Lewes by Mr. C. H. Morris (Cockerell, ‘British Naturalist,’ 1891, p. 65).

Var. *olivacea*, Risso.—Near Lavant (Rev. W. A. Shaw).

The subvar. *hepatica*, Cockerell.—“Liver colour, suture and part of spire whitish, near to f. *castanea*,” has been found by Mr. C. H. Morris at Lewes (Cockerell, *op. cit.*).

Var. *lateritia*, Dumont & Mortillet.—Shell pale opaque brick-red, bands reddish and translucent, peristome rose-coloured. A form of this variety with bands of a vinous tint has been described by Messrs. Taylor and Roebuck under the name *vinosofasciata*. Lewes (J. H. A. Jenner).

Var. *citrinozonata*, Cockerell.—Worthing (B. M. Oakshott); Lewes (C. E. Wright).

Var. *fuscolabiata*, Taylor.—Lewes (C. E. Wright).

Monst. *sinistrum*, Féruccac.—A single shell at Chichester (J. C. Melvill).

H. hortensis, Müller.—Generally distributed. Noted by Mr.

F. Dixon from the post-Pliocene beds at Bracklesham Bay, and by Mr. Alfred Bell from the "mud deposit" of Holocene age at Selsea. Large forms have been taken by Mr. C. E. Wright at Cocking.

Var. *lutea*, Moquin-Tandon.—Widely distributed.

The subvar. *lutescens* has been recorded from Brighton by Mr. J. Kidson Taylor, and from Eastbourne by the Rev. S. Spencer Pearce.

Var. *ludoviciana*, Moquin-Tandon.—Lavant (C. E. Wright).

Var. *olivacea*, Taylor.—Littlehampton (D. Taylor).

Var. *incarnata*, Moquin-Tandon.—Ore, Hastings (A. J. Alletsee); between Robertsbridge and Hurst Green (T. D. A. Cockerell); Midhurst (Cockerell); Lavant (C. E. Wright); Littlehampton, Graffham, and Charlton Forest (D. Taylor).

Var. *nigrolabiata*, Taylor.—"Ratham, near Chichester; pure yellow unbanded shells, strictly localized, and occurring with var. *fuscolabiata*, June, 1883, W. Jeffery" (Taylor, 'Monograph,' iii. 359).

Var. *roseolabiata*, Taylor.—Harting (J. Weaver); Lewes (Jenner); Barcombe (Hillman); Uckfield (Morris); Worthing (Oakshott); Bexhill (Rufford Collection, Hastings Museum).

Var. *fuscolabris*, Kreglinger.—Ore, Hastings (A. J. Alletsee); between Battle and Hastings (Cockerell); Ratham and Chichester (Jeffery); West Blatchington (R. M. Christy).

Var. *alba*, Picard.—Worthing (B. M. Oakshott).

Var. *luteolabiata*, Cockerell.—Hastings and Lavant (C. E. Wright).

Var. *fusca*, Poiret (= *baudonia*, Moquin-Tandon).—Mountsfield, Robertsbridge, and Lamberhurst (T. D. A. Cockerell).

Var. *citrinozonata*, Taylor.—Lavant (C. E. Wright).

Var. *roseozonata*, Cockerell.—Lavant, B. F. 10005 (C. E. Wright); Eastbourne (Rev. S. Spencer Pearce).

Var. *bimarginata*, Taylor.—Erringham (R. Miller Christy).

H. pisana, Müller.—The inclusion of this species in the Sussex list rests upon three specimens found in a box labelled "*H. pisana*, Sussex, Mr. W. Hawker, 1850," amongst a collection of British non-marine shells formed in the fifties by the late Mr. Frederick Townsend, F.L.S. (author of the 'Flora of Hampshire'), and presented by his widow to the Haslemere Museum

a few years ago. Unfortunately Mrs. Townsend is unable to give further information concerning them. Two of the shells are the var. *undulata*, Taylor, the other approximates to the var. *sagittifera*, Taylor.

Ena montana, Draparnaud.—Very rare, apparently found only in the neighbourhood of Harting and Ditcham, close to the Hampshire border. It has been recorded from Miscombe Hanger by Mr. C. E. Wright ('Journ. Conchology,' xiii. 342).

E. obscura, Müller.—Generally distributed.

Var. *albina*, Moquin-Tandon.—On beech trees in a wood at Fitchin, near Eastbourne (Rev. S. Spencer Pearce).

Cochlicopa lubrica, Müller.—Generally distributed.

Var. *hyalina*, Jeffreys.—Chichester district (W. Jeffery); Sompting (E. W. S.).

Azeca tridens, Pulteney.—A local species. Fairlight, Hastings (A. J. Alletsee); Ringmer, near Lewes (T. S. Hillman); between Robertsbridge and Hurst Green (T. D. A. Cockerell); Hurst Green (E. A. Butler); Mountfield (Craven); Ashburnham and Robertsbridge (Hastings Phil. Soc.); abundant in a valley near Dalegate in the parish of Newtimber (W. Borrer); Harting (Weaver); Up Park (Rev. W. A. Shaw).

Var. *nouletiana*, Dupuy.—Ringmer, near Lewes (T. S. Hillman).

Cæcilioides acicula, Müller.—A subterranean species, widely distributed on calcareous soil.

Jaminia secale, Draparnaud.—Widely distributed on the chalk, and particularly abundant where juniper bushes grow.

Var. *edentula*, Taylor.—Eastbourne (J. Loydell).

Var. *pellucida*.—In the Haslemere Museum are light-coloured pellucid specimens collected by Charles Barrett, F.E.S., on Beachy Head.

J. cylindracea, Da Costa (= *Pupa umbilicata*, Drap.).—Generally distributed.

Var. *albina*, Moquin-Tandon.—"Left-hand side of road about two miles from Lewes towards Glynde" (T. D. A. Cockerell).

J. muscorum, Linné (= *Pupa marginata*, Drap.).—Widely distributed on the Downs, and in the neighbourhood of the coast.

Vertigo antivertigo, Draparnaud.—Apparently a rare species. It may be suspected that the members of the genus *Vertigo* are frequently overlooked, and in all probability more than two species occur in Sussex. Lewes Levels (W. C. Unwin); Eastbourne (Eastbourne Nat. Hist. Soc.); Pevensey (A. J. Alletsee); Pevensey Level (A. W. Stelfox, J. C., xiii. 342); under stones in the level near Newtimber (W. Borrer); Aldsworth, near Westbourne (Rev. W. A. Shaw).

V. pygmaea, Draparnaud.—Widely distributed.

Balea perversa, Linné.—Generally distributed.

Clausilia laminata, Montagu.—Generally distributed, and, like the preceding, very abundant in beech woods.

Var. *pellucida*, Jeffreys.—Sparingly at Lewes with the type (Jenner); Charlton Forest, uncommon (E. W. S.).

Var. *albina*, Westerlund.—Not uncommon in the beech woods on the north side of Heyshott Down (E. W. S.); Coombe plantation, Lewes (J. H. A. Jenner); about Chichester (W. Jeffery).

Var. *tumidula*, Jenner.—Lewes district (Jenner); Charlton Forest (Douglas Taylor).

C. bidentata, Ström (= *C. rugosa*, Drap.).—Generally distributed.

Var. *albina*, Moquin-Tandon.—Eastbourne (A. G. Stubbs).

Var. *parvula*, Turton.—Lewes, frequent (W. C. Unwin).

Var. *glacilior*, Jeffreys.—Landport, near Lewes (J. H. A. Jenner); Battle and between Robertsbridge and Hurst Green (T. D. A. Cockerell).

C. rolphii, Leach (in Turton).—Widely distributed.

Var. *curta*, Jenner.—Ringmer, near Lewes (J. H. A. Jenner); Coghurst Wood (Raph Tate).

Monst. *decollata*, Jenner.—Lewes, with the type (J. H. A. Jenner).

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Stoat Swimming after its Prey.—On a pond in an orchard in front of my house a pair of Moorhens have hatched their young. Frequently I have heard their loud alarm notes warning their young of danger, and have watched a Stoat make many visits to the pool fruitlessly, although possibly not always so, as their young are now two less in number than formerly. When the brood have been warned, if away from the water, they quickly return and remain in the middle of the pond until they are satisfied the Stoat has left the vicinity. But in one instance I watched one of the adult birds, whilst defending its young, swim towards the Stoat to within a few feet of the water's edge, when the latter immediately took to the water and boldly swam out after the Moorhen until it satisfied itself that further pursuit was hopeless.—J. STEELE ELLIOTT (Dowles Manor, Salop).

Grey Squirrel in Buckinghamshire.—When I was walking along a path leading through a small wood, part of Whaddon Chase, between Buckingham and Fenny Stratford, on May 11th, 1915, I saw a Grey Squirrel. I do not know if this species has been introduced there, or if this individual had wandered from the site of some other undesirable introduction of this rodent.—O. V. APLIN (Bloxham, Oxon).

Remains of Roe-Deer, &c.—When visiting that wonderfully beautiful old house called Stokesay Castle, near Craven Arms, last year, I was shown some Roe-Deer horns which had been found in a well in the north tower. In one of the ruined towers of Ludlow Castle I saw the top part of the skulls and horn-cores of some cattle which were very massive and broad, but I had not time to examine them carefully.—O. V. APLIN.

AVES.

Cuckoo Problems.—In the 'Zoologist' (*ante*, p. 316), Mr. Steele Elliott, referring to the many interesting but more or less doubtful points in the economy of the Cuckoo, states that he has never known an instance of the Cuckoo's egg having been placed in the nest of its dupe before one at least of the rightful owner's had been previously

laid, and he thinks that where a Cuckoo's egg only has been found in a nest, the probability is that the egg of the foster parent has been removed. I quite agree with Mr. Steele Elliott that individual Cuckoos may remove the only egg from the nest of the dupe previous to depositing their own egg, as there is no limit to the eccentricities of individual Cuckoos; but there are many instances where this cannot apply, since many of the Cuckoo's eggs have been known to be deposited in nests which have been very far from complete, and in some cases even in deserted nests. In two instances, at least, the nests of Reed-Warbler and Pied Wagtail or Hedge-Sparrow were in such a condition when the Cuckoo's egg was deposited, that when the nests were complete, the Cuckoo's egg was nearly buried, and Mr. Pattingham even goes so far as to say that in every case he has known, the Cuckoo's egg has been laid in an empty nest. When I was at Hastings Museum a few years ago one of my sons told me he has known in that district of a Cuckoo laying its egg in the empty nest, I think he said, of a Willow-Warbler. Mr. Steele Elliott further states that he knows that the Cuckoo will deposit its egg several days after the foster parents have started incubation; but what is known of the longest time allowed to elapse before so doing? Personally, he believes the time is limited. In the 'Naturalist' for 1886, Mr. Whitlock records the finding of a Meadow-Pipit's nest containing two of its own eggs and one of the Cuckoo. The Cuckoo's egg was quite fresh, whilst the Pipit's eggs were within about three days of being hatched.

In the 'Zoologist,' 1898, p. 430, Mr. Devenport records a Cuckoo laying an egg in a Meadow-Pipit's nest in Arran; the nest of the dupe contained but one egg, and that in an advanced stage of incubation. Mr. Steele Elliott asks: "how many eggs of the foster parent are usually removed by the Cuckoo, and what actually becomes of them"? From my own observations I have found that as a rule one egg only has been removed, but again there is no limit to the vagaries of individual Cuckoos, but I believe that only in exceptional instances are more than two eggs removed. In nests where I have found two Cuckoos' eggs, the presumption has always been that two eggs of the rightful owner have been abstracted.

In the Hastings Naturalists' 'Transactions' for 1909 a nest of the Pied Wagtail is recorded with four eggs of the rightful owner and one Cuckoo's egg. Two days previously the Wagtail's nest contained six eggs of the rightful owner. With the exception of superior size the Cuckoo's egg exactly matched the Wagtail's. A very great number of instances could be given, if it were necessary,

to prove that usually one egg is abstracted by the Cuckoo when it introduces its egg into the nest of its dupe; in some instances the Cuckoo has been seen with the egg in its beak. Indeed, the proof of the removal of at least one egg of the dupe by the Cuckoo, when it foists its egg on the nest of its victim, is so great as to practically amount to a demonstration. The next question Mr. Steele Elliott raises is, What becomes of the egg or eggs taken by the Cuckoo out of the nest of its victim? I have no hesitation in affirming my belief that they are eaten by the Cuckoo, although I am aware that this is stoutly denied even by at least some naturalists of high repute. How are we to account otherwise for the number of egg-shells found in the neighbourhood of nests, which have lost one or more eggs through abstraction by Cuckoos? Moreover, we have it on the authority of Mr. Nelson recorded in the 'Field' of January 28th, 1882, that on skinning a Cuckoo he found its crop full of eggs; and in writing of the birds of the Norfolk Broads, Mr. Emerson says he found in the crops of Cuckoos what appeared to be yolk of eggs (see Mr. Gurney on the Economy of the Cuckoo). A good many other instances might be given in confirmation of this egg-eating propensity on the part of the Cuckoos. I should not, however, like to assert that its common habit is to eat eggs other than from those nests which it victimizes. A good many other points in the life-history of the Cuckoo require elucidation, amongst which might be mentioned the following:—

1. Is the well-known double note peculiar to the male?
2. How many eggs are usually laid in a season?
3. What interval elapses between the laying of each egg, and is this regular or irregular?
4. Does the Cuckoo confine its attention chiefly to one species in any one district?
5. After the laying of its eggs in the nest of its dupe, does the Cuckoo ever take any interest in its future progeny?
6. Has the Cuckoo ever been known to incubate its own egg?
7. Does the Cuckoo lay in the nests of a greater number of species than it formerly did?
8. Does the Cuckoo sometimes remove the nestlings of birds?
9. Is the Cuckoo polyandrous to the extent that it is usually asserted to be?

I should be very glad to receive information from any of your readers as to the number of species of birds the Cuckoo victimizes in any given district, or even the dominant species. The life-history of the Cuckoo is an inexhaustible subject, as well as a very fascinating

one, notwithstanding its questionable morals. It has received and is receiving more attention from naturalists than any other British bird, and the true story of this most sphinx-like of all birds is emerging into clear outline. Much, however, still remains to be learned. The actual, in relation to the possible facts of its economy, are still scanty, and in approaching this subject one thing should be kept in view, not to infer the general from the particular as has often been done in the past.—E. P. BUTTERFIELD.

Singular Nest of Willow-Warbler.—In the 'Zoologist' for August, p. 116, Mr. Warde Fowler mentions the nest of this species at some distance from the ground. I have met with three instances—one built in the upper angle of two rocks, one on the top of a whin bush, and the last built in the boss of twigs which sometimes grows around the boles of oak trees—trees whose growth has been arrested by a more or less barren soil.—E. P. BUTTERFIELD.

I see in your August issue, p. 316, a note regarding the singular position of a Willow-Wren's nest. In 1912 I found one in almost a more remarkable place—in a small white cluster rose trained over a wire archway in our garden, and about nine feet high, and on the very top. The nest contained eggs.—C. F. JOHNSON (Brampton, Cumberland.)

Blue Variety of Cuckoo's Egg in Hedge-Sparrow's Nest.—It is with unfeigned delight I record the finding in this district of the blue type of egg of the Cuckoo (*Cuculus canorus*). It makes the record all the more interesting, because the type of Cuckoo's egg found in this district is fairly constant, and approximates in size and colour to that of the Sky-Lark. The circumstances under which it was found were as follows:—I was on my way to Eldwick with my wife in early July last on the footpath which skirts the south, that is the Cottingley side, of Bingley Wood, when my wife called my attention to a small bird which was threading its way through a rose-bush a little away from the footpath, and on going to the bush I found the bird, which was a Hedge-Sparrow, sitting on a nest, and motioned for my wife to come and see the nest; but before she had arrived the bird had left the nest, which revealed four eggs. I took the eggs out of the nest, and to my astonishment one of the eggs, by its superior size, shape and texture, was undoubtedly the egg of a Cuckoo. I have never previously found the egg of the Cuckoo deposited in the nest of the Hedge-Sparrow, though I have carefully searched for one for over forty years, and have known their nests with fresh eggs close to a garden which Cuckoos have frequented in

abundance in quest of larvæ of the Gooseberry Moth. I have found the egg of the Cuckoo in the nest of the Whinchat, but never found one in this case which can be said to have approximated in the least degree to that of the dupe. It is remarkable that the blue egg of the Cuckoo is so exceedingly rare in Britain, and yet comparatively common in some parts of the Continent, and is strange, passing strange, that in those species which are commonly victimized by the Cuckoo in Britain, with the exception of the Hedge-Sparrow, the eggs are marvellously protective in colouration. We may, however, be sure that the egg of the Cuckoo has already undergone, and is at present undergoing, a process of adaptation in colouration, not by the volitional power of the Cuckoo, as has been supposed, but by the fosterers eliminating those eggs of the dupe which contrast most markedly with those of the rightful owners, and by this means those Cuckoos which lay badly matched eggs will gradually die out. It would be interesting to know whether the Cuckoo in Britain lays its egg in the nest of the Hedge-Sparrow as commonly as was formerly the case.—E. P. BUTTERFIELD (Wilsden).

PISCES.

Tameness in Several Blennies.—It is well known that the Common Blenny or Shanny (*Blennius pholis*) is an unusually intelligent fish, and that it soon becomes tame in an aquarium, but records of the precise length of time which may elapse before the Blenny begins to watch for food and to come to be fed from the hand are rarely made. The following facts seem to me to be noteworthy:—(1) A recently caught Blenny was placed in an aquarium which contained several tame individuals. It watched, from the shelter of a rock, the other Blennies crowding to the surface to be fed with beef from my fingers on the second day of its residence in the aquarium. On the third day no food was offered to the fishes, but on the fourth day the newcomer swam up with the others to be fed, without showing any fear. (2) Two Blennies were placed in an empty tank on May 3rd, and on the following morning they were each given in wooden feeding-forceps a piece of beef, which they took after a little hesitation. On their fourth day they were given more beef, which they took eagerly. From then until the present time (July 17th) they have always come up to the surface to be fed whenever the cover of the aquarium is removed. A third Blenny was put into their tank on July 1st. It watched the others, and came up to be fed on its second day. All the Blennies studied by

me, excepting unhealthy individuals or those which had been injured during capture, have learned to come to be fed from my fingers within a few days—certainly within ten days—but I have unfortunately omitted to keep a record of dates. It may be stated generally that, when once a Blenny has been induced to take food from the forceps, it thereafter begins to look for food whenever its tank is tended; and that, if tame individuals are already present, a new Blenny learns to come for food more quickly than it would do if it were alone in the tank. It is my custom to knock at the glass front of the aquarium before feeding the Blennies, and they soon learn to look for food whenever the glass is tapped. One consequence of this is that, if the fishes have not recently been fed, a touch of the hand of a visitor upon the glass often suffices to bring the Blennies crowding to the front, where they will swim eagerly about, or sit and stare at him in a very amusing and characteristic manner. I know of no other British fish which becomes tame so quickly as does the Blenny.—

H. N. MILLIGAN.

Tameness in a Sea-Bullhead.—A female Bullhead (*Cottus bubalis*) was placed in an aquarium on January 23rd. For the first three days it was shy and refused to feed, but on the fourth day it quickly seized and swallowed a piece of raw beef dropped close to its head. A second piece of beef presented to it in wooden feeding-forceps immediately afterwards was also swallowed. From the fourth day until within a few days of its death on May 9th it always took its food (beef, Shrimps, Prawns, small Crabs) very readily from the forceps, and even so soon as by the end of the first week of captivity it had begun to look eagerly upwards when the top of the aquarium was removed and the forceps introduced into the tank.—H. N. MILLIGAN.

MOLLUSCA.

Wandle Freshwater Shells.—With regard to the list of freshwater shells found at Beddington Corner, on the Wandle, which list is in the Grange Wood Museum, South Norwood, I have found lately these additional species, *Limnæa stagnalis*, *Planorbis vortex*, *carinatus*, *Bithynia tentaculata*, *Valvata piscinalis*, *Sphærium corneum*, *Pisidium amnicum*, not mentioned in the list.—G. F. BROWN (Anerley).

CRUSTACEA.

Hardiness in the Common Prawn, Aesop Prawn, and Shrimp.—I have frequently had occasion during the last three years to notice

that the Common Prawn (*Palæmon serratus*) and the Shrimp (*Crangon vulgaris*) are very hardy inhabitants of an aquarium, whereas the *Æsop* Prawn (*Pandalus annulicornis*) is very delicate. Two observations upon this point may be given:—(1) On March 19th several *Æsop* Prawns were brought from the seaside in the same collecting-can with about an equal number of Common Prawns. Both kinds of Prawns were subjected to the same conditions during capture in the dredge and carriage home in the can, and both kinds were put into the same tank. Within a few days all the *Æsop* Prawns were dead, the majority of them apparently dying from the effects of the journey, whilst the others were killed and eaten by the Common Prawns. Some of the latter are still (July 17th) alive. (2) On May 19th six Common Prawns, twenty-seven *Æsop* Prawns, and thirty Shrimps mixed together were brought in two collecting-cans from the seaside. At the end of the five hours' journey it was found that none of the Common Prawns and only two of the Shrimps were dead, but that twelve *Æsop* Prawns had died. The six Common Prawns were put into one tank, and four of them are still (July 17th) alive. The *Æsop* Prawns and Shrimps were put into another tank. By the end of May all the *Æsop* Prawns were dead, with the exception of one individual which lived until the middle of June, most of them apparently dying from the effects of the journey, and some of them being killed and eaten by the Shrimps. All the Shrimps are still alive. As an example of the hardiness of the Shrimps, it may be recorded that when they were being dropped into their aquarium on the night of the 19th, one of them happened to fall upon a dead *Æsop* Prawn, which it straightway began to eat. A few minutes later another Shrimp had begun to eat another dead *Æsop* Prawn. The experiences of other aquarium-keepers on this point would be interesting.—H. N. MILLIGAN.

INSECTA.

Acanthocinus ædilis at Sydenham.—On July 21st Mr. W. A. Fowler, of Sydenham, submitted to me for identification a living male individual of the beetle known as *Acanthocinus ædilis*. Mr. Fowler explained that he had found the beetle "in a sack of sugar exported from the West Indies," and that it had come over in a boat carrying a general cargo.—H. N. MILLIGAN.

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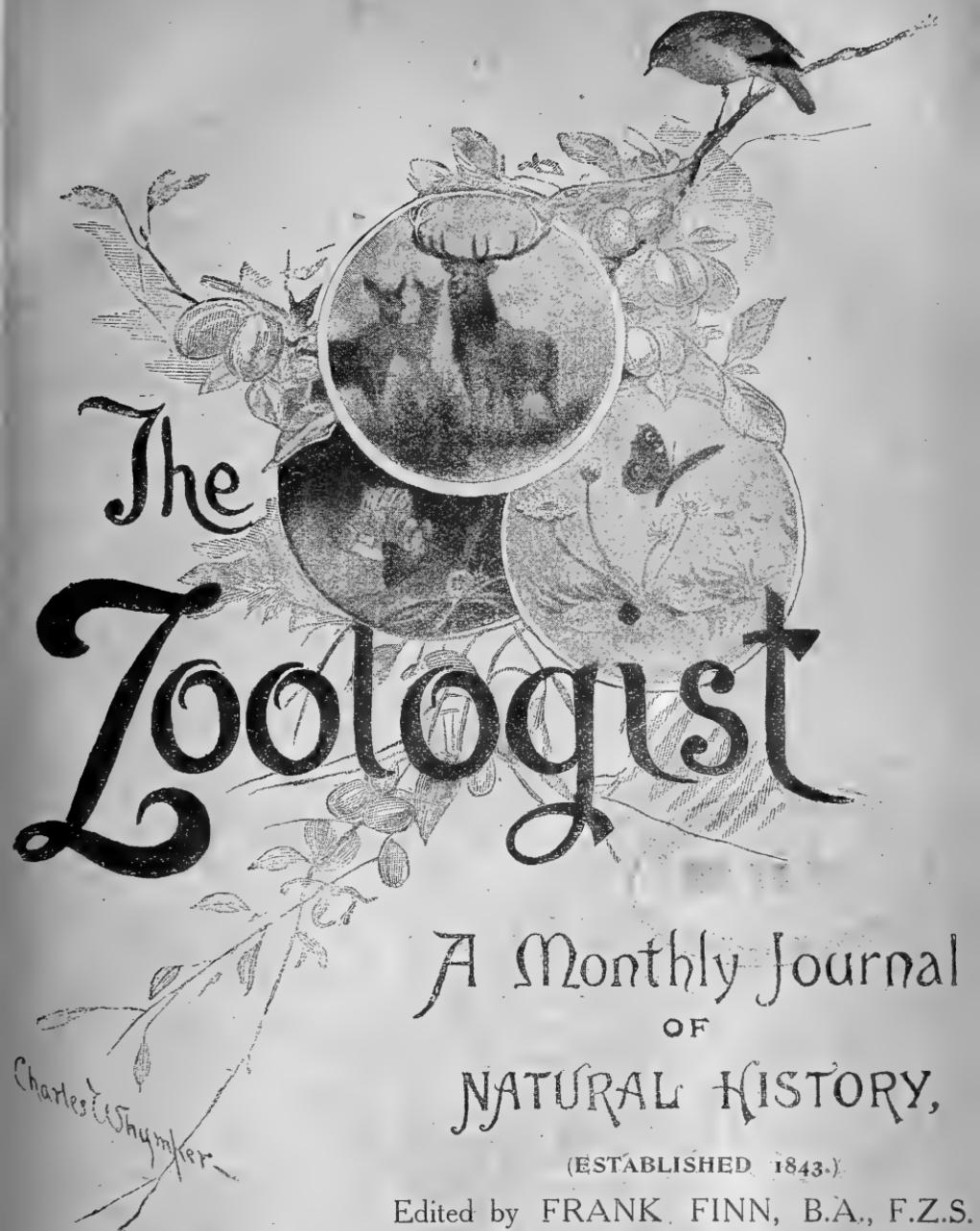
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THE ZOOLOGIST

No. 892.—*October 15th, 1915.*

SOME MISCELLANEOUS NOTES FROM GREAT YARMOUTH (1914-15.)

By ARTHUR H. PATTERSON.

THE past distressful twelve months of universal warfare and strife have not been conducive to the peaceful hobbies of the individual; and the naturalist, among others, has been affected by the unrest. However, I enjoyed a few intervals of recreation, although my notes suffered; and the birds had been on the whole much scarcer. Not a solitary Spoonbill visited Breydon during 1915, nor, indeed, any bird of exceptional interest, to the present date.

The paucity of migrants, more particularly among waders, had been very marked both in the autumn and spring, although curiously enough the first week of September, 1915, provided us with as considerable a number of interesting, although familiar, species as I can well remember; my notes on these certain dates will be given later. My impression with regard to the last autumnal scarcity is that owing to the suppression of town lights and the extinction of those of the lightships, coupled with an almost continuous absence of "raw, rafty," misty nights, the little travellers passed over high above head in unbroken flight. Under normal conditions these illuminations would hold up and bewilder them on drizzly nights, when they remain flying around, calling incessantly to each other, until dawn appears and dispels their embarrassment, and they pass on. Many, wearied and hungry, naturally break their journey for a spell by a forage and a nap on Breydon "mudflats." It is then that

“shoulder gunners” decimate the flocks, and the very few punt-guns now in occasional use belch forth destruction.

The abnormal rainfall has also had its effect upon forms other than human. The grasses around Breydon walls, grown rank and dense, owing to a shortage of labour and other causes, had not been cut down up to September; the jointed glasswort (*Salicornia herbacea*) was singularly stunted on the mudflats for want of sun, and the “cabbage” (*Ulva lactuca*) grew unusually abundant, the lack of heat keeping it green and sweet until a late date: the incoming of some stiffish tides will sweep it off in acres. The Greater Black-backed Gulls appear to have profited by it, for they might often be observed, in extended form, reaching for half a mile, like so many haymakers, throwing it over in their search for hidden small Eels and “Whitebait” left stranded by the ebb-tides, and the numbers of Shore Crabs that haunt it. A biggish tide occasionally washed large patches of it into the “drains” (channels), which sank in corner eddies, to be much frequented by Eels that root into it for crustaceans, &c. Now and then one’s Eel-line would be smothered by floating bunches, and the Smelt-nets came to shore with loads of it. Up to the time of writing (September, 1915) I never saw on the Breydon walls and marshes fewer *Tipula* (“Daddy Longlegs”); and should imagine myriads of last year’s eggs perished. I was astonished at the disappearance of the white goosefoot from the apex of the walls, where last year it grew in obstructive abundance, assuming more or less of a creeping habit. I think the Periwinkle (*Littorina littorea*) is becoming much scarcer on the mudflats, where it feeds on the *Zostera*; and Mussels are found only in a few shelly corners. Certain small “grups” opening here and there exhibited the white dead shells of the Clam (*Mya arenaria*) sticking out of the mud edgways up. The *Hydrobia ulvae*, which usually swarms on the stems of the *Zostera marina*, has been much obscured by the *Ulva*. I refer to these various outstanding features, inasmuch as they may have had certain effects on certain other species.

1914.

September 25th.—Waders fairly plentiful on Breydon, mostly Curlews, Whimbrel, Knots and Dunlins. On the following day

I observed a pair of handsome Snow-Buntings, male and female, tripping about on the sloping concrete wall: they were probably picking up the seeds of grasses and of the "wild cress." An early appearance.

An old gunner, who still retains a passing interest in Breydon, assured me that he saw an enormous flock of Curlews "make land" on the 12th, as he said "there fared to be thousands," and that they immediately broke into smaller groups and passed on. I have not had any confirmation of this arrival from any other witness.

September 28th.—A flock of weary Rooks beating up against a strong north-west wind; they seem to have had a rough time crossing the North Sea. I have heard reports of considerable numbers of birds going southwards: a big tide came up unexpectedly later on in the day, a testimony to a stiff blow from the Northern Atlantic.

Mr. J. H. Gurney wrote me on October 8th that great numbers of Lapwings, Starlings, Herring- and Black-backed Gulls, and also Wild Ducks and Finches passed North Repps and Cromer yesterday morning, all going due north (!) The Lapwings must have numbered 5000 birds. A few Kestrel Hawks accompanied them.

October.—I noticed during September, when staying at the houseboat at St. Olaves, that the Starlings feeding by day on the Haddiscoe and neighbouring marshes, pass over at eventide towards Fritton Lake, where I presume they spent the night in the reed-beds. Flock after flock repair just before sunset to a dilapidated drainage mill, about a mile up the New Cut (canal), to gossip awhile and preen their feathers, each successive flock passing onwards in rotation, thus making room for those that follow. This habit appeared to be very regular.

October 7th.—Redwings arriving: several seen in the St. George's Park.

October 16th.—Starlings are repairing each early morning to St. George's Park (our one small oasis), where they hunt in the brownish grass-bare patches, driving their mandibles with unerring instinct into the soil, almost invariably withdrawing them with a fat white Cockchafer grub. Their usual catch is six, with which they retire apparently satisfied. Park-

keeper Woods, who is an interested observer, assures me that the birds thrust in their mandibles slightly open, a likely probability, seeing that it would require some effort to separate them when in the earth. On the 20th I had a pleasant time watching several birds busily grubbing. They quartered the ground like so many Spaniels, and with all the thoroughness of Knots working a small mudflat. I noticed the Sparrows were at hand ready to steal a grub if they could catch a Starling unawares.

The washing up of tar and petrol-bedaubed Rock-birds extended a considerable way along the coast. Redbreasts very plentiful in the Park. On the 16th I observed one busy little fellow catching minute insects, leaving this pursuit on one occasion by deftly seizing a worm, which it adroitly pulled out and devoured.

October 17th.—Gulls in flocks trooping inland from the sea at 3.30 p.m. to 4 p.m. Wind directly from the east. One small lot of Rooks, very high up, came in from sea.

Starlings to the number of fifty on the park this forenoon. I examined a number of holes bored by them; they were about the size that might have been produced by thrusting in a short length of pencil. Mr. Woods assured me that "their yellow heads" may be seen occasionally at the surface: he referred to the grubs. A Thrush that had secured a grub was deliberately set upon by a Sparrow, which snatched it out of its mandibles. Some of the holes were but two inches apart, but the majority did not approach each other by a foot.

October 20th.—I took my annual mid-October stroll along the North Denes close to the telegraph wires adjoining the Midland and G.N. Railway. I usually take it on the 17th, a date when I look for the maximum of bird-migration. Unfortunately some recruits were firing at the butts, so that I felt it imperative to give up the greater part of my ramble. I had found so far only a female Blackbird (killed against the wires the previous night)—cut almost in twain; and a Continental form of the Redbreast, the latter having killed itself without any observable injury.

Gulls moulting. Miles of primaries and other large feathers of Greater Black-backed and Herring-Gulls spread along the tide-mark, feathers touching each other almost without a break.

October 20th.—The park alive with Redbreasts. Woods tells me it is the heaviest incoming of the season. I observed fourteen birds on one small patch of grass "worming." They flitted around everywhere; and seemed to be very fortunate in finding small worms and probably the larvæ of the "Daddy Longlegs." Gulls going out to sea between 3 p.m. and 4 p.m., undoubtedly making for the fishing-grounds: the Herring-drifters had not yet given over fishing.

Up to the 20th I heard of several Woodcocks arriving, the first observed was on the 17th. That sweetest of British birds, the Goldfinch, appears to be greatly on the increase on the Suffolk border, thanks to the protection laws.

[As I write these lines the electric current has been cut off—thanks to passing Zeppelins!]

Gold-crested Wrens numerous on the outskirts of the town, more especially in the park.

October 22nd.—A very red sky this morning, and the south cone up. Gulls at 10 a.m. coming in from sea in crowds, flying very high.

October 23rd.—A great number of Corvines came over to-day, Rooks dribbling in in smaller numbers all the rest of the day. Saw a Wheatear which I thought might be the Desert Wheatear (*Saxicola deserta*). A large flock of Scoters flew past the harbour mouth, evidently they had taken up their old quarters off Corton beach, where *Mactra stultorum* appears to be fairly abundant, and the low forms of life that gather upon a *Sabella* besprinkled bottom.

October 24th.—Early morning beach stroll. Few immigrants; some Rooks and Skylarks came in, and some Jackdaws, the latter flying very high, but as usual noisily. More Jackdaws on November 1st.

Wasps.—Two on as late a date as October 25th visited me in the houseboat.

A very beautiful Red-throated Diver shot at the harbour mouth to-day (October 25th). The red throat was practically perfect, the head of that slate-colour which characterises the bird in summer, with just the smallest trace of white at the base of the bill. Mr. Gurney thought its occurrence so late with such a red throat remarkable.

October 29th.—A tired-out Woodcock found sitting asleep in a doorway in the heart of the town. Gulls getting woefully short of Herring refuse.

Mr. Woods showed me to-day (November 5th) his pet Red-breast. He had collected some Cockchafer larvæ in a tin, and whistled, when out from a maze of bushes came "Bob, the Englisher," as the park-keeper termed it, and picked off a grub that had been placed on the toe of his boot. "Bob" only takes two as a meal, and flits away to hiding, turning up when hungry again in the neighbourhood of its patron, whom it finds in any part of the park where he may be working. The bird allows no intruders in his own especial quarters: he is not so pugnacious though as the "foreigners." "Bob," on seizing a grub, and repairing with it to a twig, first pecks out and destroys the head before swallowing the remainder.

On this date I received a note from Mr. Julian Tuck stating that an Eider-Duck had been hooked on a line over Britannia Pier a few days since by an Ipswich sea-angler. He saw it alive at the museum on the previous day; it ate cut-up Herrings.

November 12th.—A windy day, blowing fresh from the N.-W. All day a concourse of Great Gulls flew around high above the town hall, wheeling in great circles—a habit I have noticed several times in recent years.

Mr. R. Beazor, fish merchant, informs me to-day (21st) that a fishing boat had brought in several crans of Herrings considerably scored on their sides; the fishermen had assured him that these wounds had been caused by Gannets, of which some considerable number had frequented the Herring-grounds.

November 27th.—Straggling flocks of Rooks coming over from seawards.

Writing to the 'Anglers' News' under date of November 19th, Mr. G. A. Whistler, of Aldeburgh-on-Sea, states that he saw a flock of Hooded Crows arrive in a tired condition: "One detached itself from the others, and, evidently exhausted, dropped in the sea. It seemed to rest and swim easily close inshore, and as I approached it rose and flew to the beach. There I got within a yard or two of it, but with an effort it struggled up once more and winged its way, in desultory fashion,

to the windows of an hotel, where it hung fluttering on the ledge." I have myself observed a weary Corvine fall into the sea and rest a few moments, presently rising on the crest of a wave and again taking to wing.

There appeared to be more " Hoodies " on Breydon and the marshes than usual.

A Little Auk was picked up dead at Gorleston early in December; wind S.W. (!)

My entry for December 24 runs as follows:—

Breydon Birds.—Fine afternoon, peaceful and quiet. Rambled along the walls. Not a soul on Breydon, or near, wherryman nor gunner. Neap-tide sluggishly creeping up; town shut off by haze and smoke. Some scores of Gulls scattered about the flats, and quite a considerable number of Hooded Crows patrolling the flat-margins and grups. Many broken Mussel shells on ronds and walls. Hundreds of Dunlins, with some Ringed Plover and one noisy Redshank. A swarm of Lapwings on the marshes and quite fifty Snow-Buntings. Rat-runs very apparent on the inner grassy slope of the walls leading to water. Dead Gulls and a cat skeletonized on the rond by rats.

December 29th.—The lowlands were sloppy with excessive rain. These marshes, as far as the eye could reach, were swarming with Lapwings. I suspect that the worms being mostly ended, they were seeking larvae of *Tipula* drawn to the surface by the water.

Bearded Tit.—I am glad to report that at a certain part of the Waveney the Bearded Tit would seem to have returned. One nest was found this year by a marshman "at the bottom of the reeds" (the usual place), with one egg therein. Evidently the old birds deserted it after this first had been laid, for when mowing the reeds in the autumn this same man re-found the nest with an egg still in it.

Four " Red " Crossbills were frequenting a " corner " at Belton, making use, my informant assured me, of a " regular sort of beat of trees." This same friend, who grows flowers for market, remarked on the frequency of Goldfinches, which came to the flowerbeds and picked out the seeds from the dead summer chrysanthemums.

A Kingfisher with white primaries had been recently shot in the neighbourhood.

The bullaces left on a certain tree (which my friend does not trouble to gather) are devoured at the beginning of winter by Mistle-Thrushes, *with the stones*. Blackbirds, which also like the shrivelled-up fruit, *beat out the stones* before swallowing.

1915.

January 1st.—The “bird of the moment” is the Lapwing, which is everywhere abundant on the thousands of acres of marshland, now fairly safe from prowling gunners, so much of the area being swamped.

Mr. Alma Nicholls, writing to the ‘Anglers’ News,’ remarks on the abundance of Swans, “which are all over the place” (Broadlands). Two that he saw flew over a locomotive “so low that they went through the steam.” He did not remark on the species, but possibly most were Bewicks with a sprinkling of tame birds, and probably some Whoopers.

January 2nd.—It is not usual for Redshanks to frequent this locality in winter; but at this moment a number are known to be distributed between here and Aldeburgh-on-Sea.

A beach gunner on January 9th obtained two Little Gulls at the harbour mouth, and two Little Auks. His dog swam out and seized a third Auk, bringing it ashore alive and uninjured.

Wrens.—Quite abundant on a walk from Brundall to Cantley on January 17th.

Wood-Pigeons plentiful in the market (January 16th). I saw one stall festooned with them. The stallkeeper assured me that near Ranworth they were exceptionally numerous; he had obtained sixty in one locality.

January 23rd.—Several Pochards in the market this morning. Stiff rime frost. A note on this date received from Mr. J. H. Gurney stated that “some large flocks of Pigeons passed over yesterday which seemed to come from the direction of Lowestoft.”

A Little Auk picked up dead on the beach on the 26th.

A female Badger was killed in the neighbourhood of West Somerton (Broad district) early in February; and apparently

another female was killed by a passing train near Ormesby station, as stated to me in a letter received on August 6th.

February 13th.—My Ranworth stallkeeper had kept up a goodly show of Wood-Pigeons up till this date, and to-day had a considerable quantity for sale. On the 16th I examined a lot of ragged-looking birds, badly coloured and with poorly defined neck-patches, but in excellent condition. They varied greatly in size and weight. I put three promiscuously on the scales, when they turned it respectively at 15 ounces, 16 ounces, and 19 ounces.

February 21st.—*Breydon.*—A beautiful spring-like day. Breydon like a sunny lake. Several Herons—some grand old males; birds evidently pairing. Quite a sprinkling of Hooded Crows. Some Wigeon. A considerable flock of Black-headed Gulls; a few adult Greater Black-backs. Some Reed-Buntings along the “walls,” several Curlews, some Knots, and roughly two thousand Dunlins and Ringed Plovers on the flats.

Earlier in the week there were from two hundred to three hundred Wigeon on Breydon.

On February 28th I saw a beautiful Grey Wagtail (*Motacilla melanope*) on the rafts lying beside the edge of Breydon.

Jackdaws.—On a S.-W. wind a long flight of Jackdaws went over my house, on March 5th, before breakfast. Their noisy prating caused me to jump out of bed and rush to the window. I observed in all some one hundred and fifty birds pass over. A beach gunner had noticed this same flock from the seashore. Probably they were northward bound, but had dropped in for a rest on the marshes. Several flocks of Rooks came from east flying west. This movement covered from 8 a.m. to 12 noon; the last flock, coming inward against a fresh N.-W. by W. wind, appeared to be much wearied, and on reaching Breydon dropped low to the marshes but continued their flight, just skimming the surface.

The rookery in our market-place has been again visited by an increasing number of birds. Four nests had been built by March 17th, twenty nests by March 31st, and thirteen in the churchyard. Two new nests in a tall tree near the park.

March 5th.—Observed Hooded Crows “toying” after the

fashion of Jackdaws dropping and tumbling around each other when in flight, like tumbler Pigeons, evidently pairing.

Dunlins.—It blew hard from the west to-day (March 6th). A flock of Dunlins washed off the flooded flats flew to the south round to alight. The near birds alighted first, when the others dropped down in the rear of them, *flying backwards*, keeping their heads to wind. They sat there in so dense a body that a score might have been covered with a pocket-handkerchief.

March 12th.—Several Curlews on Breydon and some Grey Plovers.

March 14th.—Rooks coming over in thousands, passing due west, many extremely tired.

March 18th.—A yellow morning. Atmosphere colour of pea-soup. Wind from north; snowing all day. Saw a few adult Herring-Gulls and some very white Sanderlings. Breydon like a tumbling sea.

Wigeon.—There were quite five hundred Wigeon on Breydon on the 18th. On the 21st it was like a summer lake. I went round in the punt, seeing plenty of Dunlins, thirty Curlews in one flock, many Black-headed Gulls, and some Common Gulls, adult and young. Quite three hundred and fifty Wigeon busy on the *Zostera* near the watcher's houseboat. The fronds of this grass, discarded by the Ducks for the succulent stalk, began daily to float down-stream in biggish patches.

Quite one hundred Ringed-Plovers on the flats on March 24th.

March 26th.—A Woodcock of the smaller dark variety had been picked up on the sea-front, having struck a telegraph wire, cutting its crop completely open.

Crows and Mussels.—At low-water on Breydon the Hooded Crows repair to the emptied grups and wrench off Mussels, which they find attached to sunken flints and other hard substances. With these they repair to the "walls." Years ago, when nearly all the water-ward sides of them were faced by jagged flintstones, these were used as anvils on which to drop and break the shells; in many cases the mollusc fell into gaps between and was lost. To-day the birds make for the concreted slopes, easily retrieving the shellfish at the base. Small Mussels are pecked open on the hard clayey apex; the larger ones only are dropped. On March 27th the "walls" were be-

sprinkled with broken valves. On April 19th "Jim Crow" unwittingly showed me his methods. I was nearing a certain corner, walking at the grassy base of the wall, when a Hooded Crow shot up six feet above the wall, with his tail towards me, and down fell a large Mussel on to the concrete slope on the other side. He had no idea of my presence as I skulked in the grass and crawled nearer. Four times he dropped the Mussel unsuccessfully, but managed it on the fifth attempt from an increased height, when he descended in triumph to enjoy his luscious tit-bit. I rushed up the wall and surprised him, but he had already torn out the bulk of the meat. Up he flew in a hurry with four of his brethren, who had apparently waited for him to finish his dinner. A little farther on I observed a mixed flock of Rooks and "Hoodies" grubbing at Mole-heaps, evidently in search of worms and insects.

March 31st.—Two hundred and fifty Wigeon on Breydon today. A flock of thirty Knots, all as grey as in winter, feeding in almost as compact a flock as sheep. They were so tame and unsuspicious of me that they kept just ahead of my punt's bow as I rowed.

I am informed by a friend that quite thirty Bearded Tits visited a certain part of North Suffolk a week ago. Four Jays were busy in a wood as I stood chatting with him on March 31st. Eight Crossbills visited his garden yesterday. I saw a freshly killed viper hanging on a hawthorn branch. Several Snipe in the vicinity were busy, and drumming. Observed a Goldfinch busily tugging at a fir-cone on a fir-tree; and a White Wagtail (*Motacilla alba*) on the edge of a garden. The Yellow Wagtail (*M. raii*) has been singularly scarce this year.

Two unfortunate immature Black-headed Gulls caused a little talk in April among Breydon frequenters. At first sight they suggested Grey Plovers, but a nearer view showed them to be Gulls that had evidently dropped down upon floating tar or petrol; they were gray above and black beneath. All the other Gulls objected to their company and they remained together, companions in distress. They could make but a very poor flight, and undoubtedly succumbed in the end. A fisherman tells me that at sea he had caught "Kittys" (Kittiwakes) by means of tarry twine whirled around among them, and on baits

of livers and fish entrails. He had dropped the birds down the flue, sootying them all over, and then put them adrift much to the disgust of the other birds, who treated them exceedingly roughly.

April 8th.—Two beautiful Lesser Black-backed Gulls on Breydon, in company with a couple of adult Greater Black-backed Gulls. The Lesser is becoming, I think, rarer here yearly. Same date, saw Redshanks plentifully distributed along the Waveney river.

April 10th.—Numbers of Linnets (*Linota cannabina*) passing over Breydon, probably on migration.

A Cormorant on Breydon on April 10th.

When busy in my boat-shed on April 13th I heard a rare commotion among the Gulls. On hastening out I was just in time to see a Peregrine Falcon passing over to the southward at a great pace, sailing and circling. It was in all probability this bird that a marshman observed harassing Starlings—some two thousand in a big crowd—singling out a victim it dashed at and secured it. The same marshman, who was a keen shot and has since joined the army, had on one occasion seen a Peregrine “go for” a Grey Lag Goose. He told me the Goose doubled and tried its hardest to escape, but would have been struck had he not himself shot it as it dashed past him. He said he recollects a Peregrine attacking a Swan. It is a belief hereabouts that this Falcon will not attack large Gulls.

An immature Greater Black-backed Gull was pursued by several others, on April 18th, across a mudflat ; it was carrying, apparently, a parcel of fish entrails. Round and round they chased it, shrieking noisily. A Hooded Crow joined in the chase, and actually grabbed the booty as the original finder dropped it on the mud, but as he was joyfully tearing off with it the first Gull dashed impetuously at him, making him drop it in the water, where it sank beyond reach. On the 29th I saw another quarrel between Gulls, this time upon the surface of the water. Presently a bird rose with a large dead eel, which he actually managed to swallow as he went upward, but immediately disgorged it, being too lengthy to keep down, and all successive attempts were futile. I made a rush into the squabbling company with the punt, when they left me in possession

of their quarry. On lifting it into the boat on an oar I found it to be about twenty-eight inches long, as thick round as a florin. The eel had been dead some time, and floated head and tail downwards like a horseshoe in shape. Gulls are great scavengers, alike keen on carrion as on fresh meat. Wigg, a gunner, assured me he had, during some sharp weather earlier than this date, noticed a Grey- and a Black-back pulling a freshly-killed Mallard to pieces; they had so badly mauled it that he left it with them. On returning he found the remains perfectly cleaned.

May 1st.—Some Whimbrel here; more next day, and a grand old Oystercatcher, several Swallows, and six Wigeon.

Two fine adult Sheld Ducks feeding on the flats on May 7th. On this date I also observed a flock of five hundred Starlings wheeling about; they broke up into two parties, when a Whimbrel joined each, and for some minutes performed the evolutions in perfect unison without a single error.

Early morning at Brundall, on the Yare, on May 8th, provided one with a Babel of bird-song. At three the Thrushes and other songsters, hidden from view by the opening foliage, were whistling and chortling in such numbers that the accumulated chorus was novel, surprising, and indescribable. The Cuckoo called at 3.20. I saw several Swifts during the day and many Sand-Martins in the course of a long day's tramp—towing the house-boat down to the Waveney—along by the marshy river banks.

Redshanks are scarce along the Yare, and by no means so plentiful on the Bure as in my youthful days; the Waveney, with its more solitary and wetter marshes and ronds, being more greatly favoured by them. They are exceedingly fond of feeding on ronds subjected to frequent saline tides.

May 16th.—Two Black-tailed Godwits observed on Breydon. On the 20th I saw a Crow with white primaries feeding on the mudflats. On the 21st a great fight took place among the Rooks, one colony making a raid on another, pulling each others' nests to pieces.

June 1st.—About thirty Ringed Plovers and Dunlins, evidently as yet unmated, on Breydon. Some fifty Gulls, all "greys," next day; and a few Godwits and Greenshanks still with us on the 5th. An immature Cormorant for some days

frequented Breydon, choosing a particular stake for a roosting-place. He was observed to capture a goodly-sized Eel. Half a dozen Grey Plovers, only two with black vests, on the 11th.

Two large bunches of Curlews arrived on August 7th; I also saw a number of Whimbrel, some Greenshanks, and several Lesser Terns and young. About three hundred and fifty Black-headed Gulls.

Observed an adult Kittiwake Gull perched on a stranded tree-stump on Breydon on August 20th, and several times subsequently, mostly on top a stake. A rather unusual species here at any time, except in very severe easterly gales.

The first Wasp of this season looked in at the houseboat on August 25th, although for some time at a neighbouring village they appeared to swarm. In a grocer's sugar-bin I saw a colony of them! Mosquitos were troublesome at night on the Waveney, when I was Eel-fishing near the reeds: I found that anointing my face and neck with Worcester sauce was a most effective protection. They do not bite, but annoy me when their attentions are diverted my way. Quite a thousand swallows, including some Sand-Martins, on the telegraph wires near Haddiscoe Canal.

A Long-horned Owl passed over me when Eel fishing on the night of August 26th; a great Noctule Bat flitted into its line of flight, when I presume the scent of the bird, left behind it, very much perturbed the flying mammal.

August 28th.—Very high tide on Breydon; I had pulled out my smaller Breydon Noah's Ark, and was surrounded by Swallows and Sand-Martins busily snapping up small insects, and probably small Beetles which had climbed to the heads and tufts of the saline plants, just above the surface of the water. A great concourse of Gulls, in extended order, patrolled the flats at low water, turning over the *Zostera* and *Ulva* most systematically in search of Crabs, &c.

Hundreds of Black-headed Gulls on Breydon on August 31st. Several Curlews and Godwits came in from due east, August 31st, making a great clamour.

Flock of Wigeon, September 1st. A wild night on Breydon on May 2nd, when I sailed my little punt, with rowing chocks often under water, homewards. The sky was brilliantly fiery,

and the clouds of marvellous shapes and colours at sunset. Passed many waders on one flat, and many Gulls. The roughest passage I have ever made in this cockleshell.

Hundreds of Dunlins and Ringed Plovers, in scattered flocks all over Breydon. Many Godwits and Grey Plovers; the plaintive notes of the latter were so incessant and monotonous that they almost got on one's nerves. Six Little Stints on a salting.

A White House-Martin seen at Horning in September, having been bred there. A hand-reared Mallard had been seen perched on a motor-shed; and a Snipe on top a telegraph pole in the same neighbourhood.

September 5th.—A Babel of bird sounds—a jumble of low whistling notes from the flocks of waders collected on the higher parts of the flats at high water to-night was remarkable. I passed one area of some 50 square yards crowded with Godwits, Grey Plovers, Curlews, Knots, and other waders, and so near that a hat might have been thrown into their midst. And the Gulls on a distant flat were cackling loudly and incessantly.

More migrants.—Sailing down Duffells Drain, from my small houseboat, on the morning of September 6th, I passed another congregation of waders, among them many Knots (one gunner secured thirty), Grey Plovers, Curlews, and, I believe, some Curlew-Sandpipers among other small birds; probably several rarer birds were here to-day. Dunlins and Ringed Plovers were flying everywhere in flocks of various sizes. I have not seen such an immigration here in early September for several years.

THE RELATION OF THE OYSTERCATCHER TO ITS NATURAL ENVIRONMENT.

By J. M. DEWAR, M.D.

(Continued from p. 346.)

V.—DISCUSSION OF THE SUMMER ENVIRONMENT.

The conditions common to most of the stations of the summer habitats are the following: a body of fresh water, a breeding area of water-worn shingle, composed of light grey stones of medium or small size, the area being adjacent to water, raised above the level of summer floods, and fairly well-preserved from human intrusion; a local feeding-ground to which there is easy access for the young on foot, rich in tipulid and coleopterous larvæ, and with at least a moderate supply of large earthworms; a more distant feeding-ground of cultivated land, accessible to the adults, and richly stocked with large earthworms.

The first condition is an essential requirement and is used in many ways, of which the act of drinking is only one. Both the adults and the young bathe in the water, and stand in it by the hour. A large still body of water, or a narrow deep or quickly flowing stream, safeguards one border of the breeding area from intrusion, and favours the detection of approaching danger. The young in danger frequently crouch in shallow water among stones, and in the last resort swim boldly out on the open lake or across narrow and not too rapid streams. In the river settlements especially, a portion of the food supply for the young is got from the shallow waterside.

Shingle does not form a necessary condition of the breeding area. It is absent from North Holland where the birds nest commonly on areas of grey mud, as do most of the birds in the Moulinearn Settlement, while at Ballinluig nesting on turf under trees is common. On shingle, however, the eggs and young are incomparably harder to find than on any other substratum used

in this locality. At Moulinearn and Ballinluig the young are led to the shingle soon after they leave the nest, and thenceforth the shingle forms both their refuge and resting place. The eggs laid on mud or turf are not better protected by their surroundings than they would be on shingle, but in disturbed areas they have a better chance of escaping human observation which, by tradition or personal experience, tends to be concentrated on the shingle. The young get the benefit of the shingle even in disturbed areas, because, unlike the eggs, they can occupy positions likely to evade detection on the approach of danger. And in all the stations examined, with the exception of those in the hill-stream habitat and in the aberrant area of the Garry, the shingle forms the headquarters of the young. In wet weather, however, the shingle looks almost black. The eggs and young then show up more distinctly. But the deficiency has less importance than it seems to have. The adults, which stand out conspicuously from the dry light grey shingle, assimilate more or less completely to the shade of the wet stones, and during wet weather the parents are covering either the eggs or the young. After a short exposure to rain the wetting of the outer down changes its hue from light greyish to drab. The young then approach in shade that of the wet stones.

Evidently the essential requirement of a breeding territory is an open area of sufficient extent, and approximating in colour appearance to that of the eggs and young. These conditions are best fulfilled by shingle devoid of vegetation. The bareness of the normal breeding territory has, however, a wider significance. After the young are hatched, and for several weeks to come, they are prevented by the parents from going among wet grass when the temperature is low. The combination of moisture and low temperature occurs regularly in the early morning, and occasionally through the daytime as well. The chicks are compelled to remain on the shingle where, though the stones may be wet, the chicks at least remain dry. The proceeding must have attached to it a pronounced biological advantage, for I have repeatedly seen hungry chicks which have already learnt the association of the position of the feeding-ground with the act of being fed, trying to entice the adults to follow or lead them on to the wet grass to be fed. A second result of the bareness

of the nesting area is the poverty it shows of animal food. The normal hatching of the chicks coincides with the presence of large numbers of Stonefly nymphs under the stones at the water's edge. These nymphs are fed extensively to the young soon after they leave the nest. Beyond this the breeding area contributes little or nothing to the feeding of the young, and the need is insistent for an additional area capable of supplying the food required. In all the occupied areas the shingle or mud stands high enough to be above the probable level of spring and summer floods. It matters little for the young, but it may be serious enough for the eggs. Evidence is not wanting to show that the nesting activities in relation to water level are adjusted to the normal breeding time only. When a second laying becomes necessary, adjustment is not so accurate.

On the shingle nesting and the rearing of young are confined to those parts where the stones are not larger than the eggs. The stones may, however, be much smaller—little more indeed than fine gravel—without preventing nests being formed and eggs laid. But wherever the stones are considerably larger than the eggs nesting does not occur, unless there are islets of smaller stones amongst the larger. These islets are used occasionally, even though little larger in area than the nest itself. But the protection afforded to the nest by the substratum is inadequate, for the nest, together with the clutch, break the monotony of the general surface, and are fairly easily found. Though the young, in the act of crouching, may respond to a larger boulder by moving up against it, they invariably rest on shingle not larger and often smaller than themselves, and the bulk of their activities, within the breeding territory, is confined to areas of shingle whose components are of medium or small size.

On the River Lyon a pair of Oystercatchers breed successfully on a small shingle island near Chesthill. The island is wholly devoid of vegetation, and completely isolated by turbulent rapids. The history of the settlement was not worked out. But the difficulty of evoking the crouching response of the young from the mainland, and the comparative indifference of the adults to one's presence, render it unlikely that the young are not born and bred on the island. Thus a local feeding-ground, accessible to the young, is not a necessary condition of the

summer environment. In all the other stations, with the exception of Clunie, where eggs have not been known to hatch, a local feeding-ground is present, and may, therefore, be regarded as having great ecological value.

The most valuable conditions of the local feeding-ground are the presence of a large stock of tipulid and beetle larvæ, and comparative freedom from human intrusion. The conditions are best fulfilled by fenced-in old pastures. Ground of this nature is attached to most of the breeding areas. On the Orchy, however, it is absent, and the grassy river-bank takes its place. The great value of an area of old turf is made evident by the history of the Dunavourd territory, where the breeding territory ceased to be occupied whenever the old pasture was ploughed. Occasionally arable land forms the local feeding-ground. In the middle Logerait settlement, and on a shingle island in the River Lyon near Chesthill, wooded islands are the only available local feeding-grounds. The upper island at Logerait and the island at Chesthill are apparently of natural origin, and provide a different food supply for the young from that occurring in the normal feeding-ground. The fauna of the ground strata of the naturally wooded islands appears to be that of the flood-plain forest association.

The third area of a favourable station—the general or distant feeding-ground—has, as its chief functions, the feeding of the adults and the supply of large earthworms for the young. For the latter purpose cultivated land is best adapted. Cultivated land adjoins all the breeding areas of the Tummel, Garry and Fender. Under certain conditions (*e.g.* drought) the young receive very little food from farm land. Arable soil is practically absent from Upper Glenlyon, and from Glenorchy above the Bridge of Orchy. It is, therefore, not essential. But the distribution of the birds shows that, wherever the unproductive hill-side takes the place of cultivated land, a much larger area is required to support the same number of birds. The occurrence of cultivated land in the environment is, of course, a secondary condition. It is possible the distribution of the boulder clay, and especially its presence on south-western exposures, favoured the settlement of the earthworm, and thus effected a primitive control over the distribution of the Oystercatcher population,

and cultivation, by still further favouring the earthworm, only confirmed the process.

Summing up the essential conditions of the breeding habitat, we have: a sheet or stream of water; a nesting area to which the eggs, and more especially the young, have a protective resemblance; a general feeding-ground accessible for the adults and providing a large supply of earthworms; comparative immunity from enemies in the breeding territory. A local feeding-ground is of so general occurrence, that it may be regarded as approaching the essential. The requirements here are accessibility for the young, a large stock of tipulid and coleopterous larvæ, and a certain freedom from disturbance.

In summer enemies have a greater influence than in winter. Most injury is wrought before the end of incubation. So much is this the case that, if only the young can be hatched, they have a very good chance of reaching the stage of flight. Most destruction is caused by man. He takes the eggs, while youths, as I have observed, stone the young. The adult birds do not suffer in themselves through the agency of man. On the contrary, they benefit, as I have shown. In nesting areas, to which sheep and cattle have access, the eggs may be trodden upon. On one occasion I witnessed the actual event: on another I found a nest containing crushed and flattened eggs, to account for whose state cattle were the most likely explanation. The young do not appear to suffer from these animals. But they may come to grief from the chance step of a human being, as then the adult birds do not interrupt the special means which serve as stimuli for the crouching reaction. Without disturbing the crouching response in the least degree, I have abraded the skin of a chick which I failed to see in time to avoid the accident. The Buzzard causes a good deal of commotion, but has not been seen to attack the young. The Sparrowhawk, Kestrel, and Merlin produce little effect. The Lesser Black-backed Gull, as it sails over the breeding area, has a profound influence upon the situation. The young Oystercatchers crouch at once in response to the warning call of the adults, which, thereafter, stand absolutely still in dumb watchfulness. No attack has been observed. The Black-headed Gull, which often tries to snatch away the young of the Ringed Plover

and Lapwing, has been observed to threaten only the very young Oystercatcher. The effect of ground vermin is not known. But no eggs or young under observation have disappeared without the disappearance being accounted for, at least as well, in other ways.

In the breeding season, so far as one is able to judge, the succession of day and night is a factor, but not an important one, in regulating the activities of the birds. The diurnal cycle is rather complex, but it may be summed up as a periodic alternation of rest and activity, the latter being of two kinds—nuptial or social, and food activities. It should, however, be understood that these periods are not simply periods of rest and activity. All that can be said is that in one period the resting phase predominates, in the next the active phase, and so on alternately. The period of greatest darkness lasts from about 11 p.m. to 1 a.m. Contrary to what one might expect, it is not a period of rest but is rather a period of the wildest activity, and that apparently not of food-getting, but nuptial. Activity continues till 4 a.m., but it passes gradually into food-getting for both adults and young. After 4 a.m. the sun begins to diffuse an appreciable warmth. Activities lessen, and a quiescent period appears which lasts till 10 a.m. During the earlier part of this period most of the "apparent" sleep is obtained. Ten a.m. till 2 p.m. is a fairly active period, devoted mostly to food-getting. From 2 p.m. till about 6 p.m. the birds are mostly resting except for occasional and short-lived storms of either kind of activity. After 6 p.m. the birds are really active, at first in getting food for themselves and the young, and then, by degrees, the feeding activity is interrupted by the nuptial activities which later work up into the fully developed midnight orgy. Such is in general outline the diurnal rhythm of the Oystercatcher at an inland breeding station. Exceptional features, of course, occur at any hour and place, and very frequently the normal rhythm is entirely upset. On very dark nights all activities, so far as one can then determine, are suspended for the hour or so of greatest darkness. On very clear nights many birds (? barren) leave the breeding areas and make extended journeys into the hills, where they are not seen in the daytime.

It will be observed that the two periods of rest coincide, the

one with the period in which the warmth of the sun is first beginning to be felt after the cold of the early morning, and the other with the period in which the heat of the sun is most fully developed, and that the two chief periods of food-activity, that is morning and evening, coincide with the periods of greatest activity in the earthworm. It is probable that the periods of rest have become rhythmic habits, at least during the breeding season, for they appear even when the weather is cold and wet.

In the breeding quarters the variations of temperature, occurring in May and June, have no apparent effect on food-supply; any disturbance that takes place being due more probably to the other climatic conditions commonly associated with temperature extremes. In hot weather the adults may become dull and listless, but the condition does not last long owing to the frequent recurrence of food—and other activities. The chill of night has evidently no more than a bracing effect on the birds. One instance of "physiological misery" has come under notice. An adult, after a spell of food-getting for the young in the early morning, bathed about 4 a.m., and then went to "apparent" sleep. The rigor which followed lasted a considerable time. The young bear wide variations of temperature with equanimity. During the first two days of life they are very sensitive to cold, and are covered almost continuously. Thereafter, they have to rub along on all sorts of days without additional warmth, except during the coldest part of the night. They seem indifferent to hot sunshine, and I have not seen them shelter under the wings of the parent when the sun is particularly hot, as young Lapwings do in similar conditions.

In summer no injurious effect of excessive moisture on adults or young was discovered. Both are extremely hardy, and they then enjoy an abundance of food, especially of earthworms. Drought reduces the supply of these both for the adults and the young. Worms may even be unobtainable. If worms cannot be got, efforts are rarely made to bring other food from the distant feeding grounds, and prodigious exertions are evoked to supply the wants from the feeding area attached to the nesting quarters. The sun-baked ground is hammered and pickaxed with the powerful bills, the parents working feverishly, and for long periods at a time, to supply the necessary quantity of food

for the young. Occasionally, young have been seen to manifest signs of more than passing hunger owing to the drought-induced dearth of earthworms and the difficulty of getting other supplies. But in no observed instance have the young appeared to suffer permanently in consequence of the shortage.

VI.—THE CHOICE OF A NESTING-SITE.

In the choice of a nesting-site which is placed near a body of water, an important factor must be the relation existing between the position of the nest and the level of the water at the time of building, and any possible rise in the level of the water during the subsequent period of laying and incubation. In the river-valley habitat the nests are formed on the highest part of the banks of shingle, and in the case of the semilunar beds, which form on the convexities of the alluvial cones, the nests are laid on the longitudinal ridge which has formed in the shingle, a short distance from the grass bank. In the lake-shore habitat, as represented by Loch Tummel, the problem does not appear to be so simple. The beach of the alluvial cones has, for the most part, an even gradient from the water-edge up to the grass. The nests, as a rule, are formed on, or about, the highest winter water-mark. But in places the mark is not evident, and apparently is not detected by the birds. In other parts the high-level mark reaches up over the grass. Where this happens, the nests are formed on the shingle within a half to one metre of the bank. It is probable that, in the choice of a nesting-site in this locality, the adjustment of the bird to the environment is more perfect at the normal period of laying than it is at a later time. This may be put in another way by saying that the normal period of laying occurs at a time when the level of the loch is already low and still falling. At a later period the loch is either at bottom level or has actually begun to rise. At the former period the choice of a nesting-site is stereotyped, appropriate to the local conditions, and successful. At the later period the birds respond with the stereotyped reaction to conditions which are essentially, though not obviously, different from the normal, and which day by day may depart still further from the normal.

(To be continued.)

A CATALOGUE OF THE LAND AND FRESHWATER MOLLUSCA OF SUSSEX.

BY E. W. SWANTON.

(Member of the Conchological Society; Curator of the Educational Museum, Haslemere.)

(Concluded from p. 353.)

(PLATE IV.)

Succinea putris, Linné.—Generally distributed.

Var. *solidula*, Jeffreys.—One specimen near Lewes (C. H. Morris).

S. elegans, Risso.—Widely distributed.

Var. *longiscata*, Morelet.—Pevensie Castle Moat (Rev. W. A. Shaw).

Var. *pfeifferi*, Rossmässler.—Frequent with *S. putris* at Lewes (W. C. Unwin); Hastings district (Tumanovicz); near Pulborough (E. W. S.).

Var. *virescens*, Morelet.—Near Bosham (Rev. W. A. Shaw).

Carychium minimum, Müller.—Generally distributed in damp situations.

Ancylus fluviatilis, Müller.—Generally distributed in clear running streams.

Var. *albida*, Jeffreys.—In a tributary of the Rother near Midhurst (W. Jeffery).

Acroloxus lacustris, Linné.—Locally abundant in ponds and sluggish streams; there are many records from both divisions of the county.

Var. *albida*, Jeffreys.—In a pit at Bosham (W. Jeffery).

Limnæa auricularia, Linné.—Very local. Ponds and sluggish waters. Lewes, in the "Cut," rare (W. C. Unwin); the Rise, Lewes (C. H. Morris); ditches, Pett Levels (R. Tate); Chichester district (W. Jeffery); Littlehampton (D. Taylor); Bognor (H. L. F. Guermonprez).

Var. *acuta*, Jeffreys.—Southover, Lewes (Jenner); ditch near the railway, Eastbourne (Hastings Phil. Soc.).

Var. *ampla*, Hartmann.—In ponds in a garden at Ratham, Chichester (W. Jeffery).

L. pereger, Müller.—Generally distributed; of frequent occurrence in the mist ponds on the Downs.

Var. *candida*, Porro.—Wannock Glen and the Pevensey Marshes (G. A. Stubbs).

Var. *labiosa*, Jeffreys.—Pond between Horsted Keynes Church and the station (W. Whitwell).

Var. *marginata*, Michelet.—“ Taken by Mr. C. H. Morris in an isolated pond on the Downs near Lewes. This curious form perhaps arises from excess of calcareous matter in the water, as at times the pond is thick with chalky mud brought down by the rains ” (J. H. A. Jenner).

Var. *ovata*, Draparnaud.—Chichester district (W. Jeffery); Harting (Weaver); Southover Marshes, Lewes, and at Battle (Jenner); fish-ponds at Fairlight (R. Tate).

Var. *acuminata*, Jeffreys.—Ratham and Chichester (W. Jeffery).

Var. *inflata*, Kobelt.—Affluent of Ouse, between Burnt Oak and Hayward’s Heath (W. Whitwell).

Var. *oblonga*, Jeffreys.—Lewes (Gwyn Jeffreys).

Var. *lacustris*, Leach.—St. Leonards (R. Tate).

Monst. *scalariforme*.—A fine specimen at Thorney (Rev. W. A. Shaw).

L. palustris, Müller.—In sluggish waters; widely distributed.

Var. *albida*, Nelson.—Near Lewes (C. H. Morris).

Var. *elongata*, Moquin-Tandon.—Winterbourne Stream, Lewes (Jenner).

Monst. *decollatum*, Jeffreys.—Pond at Battle (Jenner); Pevensey (Rev. W. A. Shaw); Surrey and Sussex Canal, near Alfold (E. W. S.).

L. truncatula, Müller.—Very common. This species is the intermediate host of *Fasciola hepatica*, an endodermic parasite which causes “liver-fluke” disease in sheep.

Var. *minor*, Moquin-Tandon.—Near Lewes (C. H. Morris).

L. stagnalis, Linné.—Widely distributed. Mr. Clement Reid records that it was once found in a dew pond on the Downs.

Var. *labiata*, Jeffreys.—Ratham, Chichester (W. Jeffery).

Var. *fragilis*, Linné.—Lewes, in the Pells (W. C. Unwin).

Var. *variegata*, Hazay.—Winchelsea (Rufford collection, Hastings Museum).

L. glabra, Müller.—Ditches and shallow pools, rare. Wayside pools beyond the Great Pool. Horsted Keynes (W. Whitwell); Water-hole by roadside at Framfield, near Uckfield (Rev. C. E. Y. Kendall); near Malling, Lewes (W. C. Unwin); Heathfield (E. A. Butler); in narrow grassy ditches at Albourne, Cowfold, and Henfield (W. Borrer).

Planorbis corneus, Linné.—Ponds and sluggish streams, widely distributed.

Var. *albina*, Moquin-Tandon.—Lewes (C. H. Morris); near Arundel (W. Jeffery).

P. albus, Müller.—Generally distributed in ponds, lakes, and ditches.

P. glaber, Jeffreys.—A very rare species. Only two Sussex records. Shoreham (W. Jeffery, 'Journal of Conchology,' v. 41); "I have found this species in a small pond in my own grounds at Cowfold" (W. Borrer, quoted by Harting, 'Zoologist,' 1878, p. 165).

P. crista, Linné (= *P. nautileus*, Linné).—A common species. The smooth form known as var. *lævigata*, Adami, is equally abundant as the type.

P. carinatus, Müller.—Locally abundant in ponds and slow-running streams. Lewes Levels (W. C. Unwin); marsh ditches, Southover, Lewes (Jenner); Malling Marshes (Unwin); Hastings (Diplock's 'Guide'); common in the levels of the Arun and Adur (J. E. Harting); Harting (Weaver); Surrey and Sussex Canal, near Alfold (E. W. S.).

P. umbilicatus, Müller (= *P. complanatus*, Jeffreys).—Abundant in ponds and slow-running streams.

Var. *rhombea*, Turton.—Marshes between Lewes and Newhaven (W. C. Unwin); Lewes (Rev. C. E. Y. Kendall).

Monst. *terebrium*.—Ratham, Chichester (W. Jeffery); Pevensey (Rufford collection, Hastings Museum).

P. vortex, Linné.—Widely distributed in ponds and slow-running streams. Frequently malformed.

Var. *compressa*, Michaud.—Pevensey (A. J. Alletsee). There

are specimens in the Rufford collection, Hastings Museum, also a scalarid example.

P. vorticulus, Troschel. (Plate IV.)—It bears much resemblance to immature *P. vortex*, but the body whorl is only very slightly keeled. Until recently in this country it was known only from Pleistocene deposits at West Wittering (Messrs. B. B. Woodward and A. Santer Kennard). In 1911 it was found sparingly in the living state in Malling Marsh, near Lewes, and Pevensey Levels by Mr. Edward Collier.

P. spirorbis, Linné.—Common. Mr. Clement Reid notes that this species and *P. vortex* occur in the mist ponds on the Downs.

Var. *albida*, Nelson.—Lewes (C. H. Morris).

P. contortus, Linné.—Widely distributed in ponds and ditches.

Var. *albida*, Jeffreys.—Lewes (C. H. Morris); Pevensey Marshes (Rev. W. A. Shaw).

P. fontanus, Lightfoot (= *P. nitidus*, Müller, of Jeffreys).—Generally distributed in ponds and sluggish waters.

Segmentina nitida, Müller (= *Planorbis lineata*, Walker).—A local species. Abundantly distinctive in the Nautilus-like septa. About Lewes (Borrer, and many others); Winchelsea (A. J. Alletsee); Pevensey Marshes (A. G. Stubbs, and many others); pond between Hurst Green and Lamberhurst (T. D. A. Cockerell); in a pond at Old Deane Farm, Henfield (W. Borrer); Harting (Weaver).

Physa fontinalis, Linné.—Generally distributed.

Aplecta hypnorum, Linné.—A local species. Pevensey Levels (E. A. Butler and others); Barcombe (Jenner); Bopeep and Guestling (Rev. E. N. Bloomfield); stream at Wellingham and at Leighside (Eastbourne Nat. Hist. Soc.); Winchelsea and Snailham (Craven); Ratham, near Chichester, and Lindfield (W. Jeffery); near Pulborough (E. W. S.); Singleton, Chidham, and Bosham (Rev. W. A. Shaw).

Paludestrina confusa, Frauenfeld.—It occurs in the Pleistocene deposits at West Wittering, where it was first detected by Mr. Clement Reid. Regarding it as synonymous with *Pseudamnicola anatina*, Drap., Mr. Craven records it as common at Winchelsea and Snailham ('Hastings and East Sussex Naturalist,' ii. 101, April, 1914).

P. jenkinsi, Smith.—Frequenting brackish waters. Locally abundant. Lewes (C. H. Morris, 1894, and more recently by other observers); ditch at Litlington, near Eastbourne (A. G. Stubbs); Pevensey Marshes (Rev. W. A. Shaw); in ditches connected with the River Adur at Beeding (L. E. Adams, J. C., xiii., 68).

P. ventrosa, Montagu.—In brackish waters. Pevensey (A. J. Alletsee); near Winchelsea, in ponds on beach (E. A. Butler).

Var. *pellucida*, Jeffreys.—Thorney Island, plentiful (Rev. W. A. Shaw).

P. stagnalis, Basier (= *Hydrobia ulvae*, Pennant).—Frequenting brackish water. Camber Sands, Rye (E. A. Butler); River Adur, Shoreham (Rev. C. E. Y. Kendall); Bognor (H. L. F. Guermonprez); Bosham and Pagham (Rev. W. A. Shaw). It is probable that the species of *Paludestrina* recorded above are widely distributed on the Sussex coast, though the records are very few.

P. marginata, Michaud.—It is recorded from Pleistocene deposits at West Wittering by Mr. J. P. Johnston. Extinct in Britain, but surviving in France.

Bithynia tentaculata, Linné.—Generally distributed.

Var. *ventricosa*, Menke.—Common in the Levels, Lewes (W. C. Unwin); marsh ditch near Camber Castle (Eastbourne Nat. Hist. Soc.).

Var. *albida*, Rimmer.—Pevensey (Rufford collection, Hastings Museum).

Monst. *decollata*.—Canal near Alfold (E. W. S.).

B. leachi, Sheppard.—Widely distributed.

Var. *albida*, Rimmer.—Pevensey Marshes (Rev. W. A. Shaw). A form with raised longitudinal brown stripes was found near Pevensey by Mr. P. Rufford.

Vivipara vivipara, Linné (= *Paludina vivipara*, L.).—Canals and sluggish streams; rare. Pevensey Level and the marsh drains between Siddleham and Selsea (J. E. Harting, as doubtful). “The only recorded locality for this shell is the River Arun (W. Borrer, in ‘Zoologist,’ 1878). I found it numerous at Wisbro’ Green in 1877 in a ditch supplying the Wey and Arun Canal. It probably came from the Wey” (W. Jeffery). Bognor (H. L. F. Guermonprez).

Valvata piscinalis, Müller.—Ditches, canals, and sluggish streams; generally distributed. Mr. W. Jeffery once took “about three hundred and fifty shells from the stomach of a large Eel, nearly all of which belonged to this species.”

Var. *albina*, Jeffreys.—Lewes (C. H. Morris), Litlington, near Eastbourne (A. G. Stubbs).

V. macrostoma, Steenb. (Plate IV.)*—This species closely resembles the var. *depressa* of *V. piscinalis* (a variety which differs from type in the very depressed spire and broad umbilicus), but Mr. Edward Collier and others note that it is quite different in texture and colour of shell. It has been taken by Mr. Collier in Malling Marsh (Journ. Conch. xiii. 285, 316), and at Chidham and Pevensey Levels by the Rev. W. A. Shaw.

V. cristata, Müller.—Generally distributed.

Assemania grayana, Leach.—This species is included by Mr. Frederick Dixon in his ‘Geology and Fossils of the Tertiary and Cretaceous Formations in Sussex’ (1850), in a list of the “more obvious examples” of shells found in the post-Pliocene deposits at Bracklesham Bay, and named for him by Mr. G. B. Sowerby (p. 17).

Pomatias elegans, Müller (= *Cyclostoma elegans*, Müller).—Widely diffused, abundant on the chalk, absent from the Vectian sands about Blackdown. The Rev. W. A. Shaw has found it in a post-Pliocene deposit at Kingley Vale, West Stoke.

Var. *ochroleuca*, Moquin-Tandon.—Always with the type about Shoreham, Lewes, and Steyning (Rev. C. E. Y. Kendall); Heyshott Down (E. W. S.).

Acicula lineata, Draparnaud.—Apparently very rare. Mr. Ralph Tate found it in Fairlight Glen and Coghurst Wood. There are no records from the western division of the county.

Neritina fluviatilis, Linné.—Very local. “Locally common in the Ouse, Cuckmere and East Rother districts. Plentiful in the Cockshute Stream at Lewes” (J. H. A. Jenner); “plentifully in the Arun, a few miles above the town of Arundel” (W. Jeffery);

* Plate IV.—*Valvata macrostoma*, Steenb. Shells, nat. size (inset) and magnified 6·66, the central one shows the operculum *in situ*. *Planorbis vorticulus*, Troschel. Shells, nat. size (inset) and magnified 6·66. From specimens loaned by Mr. Edward Collier.

"from mud thrown out of a ditch in the level of the Arun between Burpham and Arundel" (W. Borrer).

Unio pictorum, Linné.—Widely distributed.

U. tumidus, Retzius.—Very local. Ouse, Cuckmere, and East Rother districts (Jenner); Hastings district (Hastings Phil. Soc.); in the muddy bottom of the Brede River, abundant (R. Tate).

Anodonta cygnæa, Linné.—Widely distributed.

Var. *anatina*, Linné.—Sometimes classed as a species. "Burton and Wisboro' Green, have taken the var. *complanata* at Burton (W. Jeffery); Cowdray Park (D. Taylor); Landport, near Lewes (Jenner); Plumpton and Norlington (C. H. Morris); Pevensey Sluice (Eastbourne Nat. Hist. Soc.); Crowhurst and Robertsbridge (Hastings Phil. Soc.).

Var. *incrassata*, Sheppard.—Powder Mill, Battle (Jenner). Specimens in the Hastings Museum were obtained from this locality by Mr. E. J. Bailey.

Corbicula fluminalis, Müller.—It has been recorded by Mr. J. P. Johnson from the Pleistocene at West Wittering. A widely distributed fossil on the Continent; in Britain not known outside of the Thames-Rhine system.

Sphaerium rivicola, Leach.—Sluggish rivers and streams. Rare in Sussex. Near Hastings, rare (Rev. E. N. Bloomfield); Arun at Burpham, near Arundel (W. Borrer).

S. corneum, Linné.—Generally distributed in ponds and ditches.

Var. *nucleus*, Studer.—Lewes Marshes (J. H. A. Jenner).

Var. *flavescens*, Macgillivray.—Millstream at Burton, near Petworth (W. Jeffery); Cockshute, Lewes (C. H. Morris).

S. lacustre, Müller.—Widely distributed.

Var. *brochoniana*, Bourguignat.—Rotham, near Chichester (W. Jeffery).

Var. *ovalis* Féruccac.—Landport Marshes, near Lewes (J. H. A. Jenner).

Pisidium amnicum, Müller.—Common in lakes, ponds, rivers, and canals.

P. henslowianum, Sheppard.—Ponds, ditches, and sluggish streams; apparently rare. Lewes Levels (W. C. Unwin); Northchapel (D. Taylor); Surrey and Sussex Canal, near Alfold (E. W. S.).

P. subtruncatum, Malm. (= *P. fontinale*, Jeffreys).—Widely distributed.

P. pulchellum, Jenyns.—Apparently rare, only three records. Ditches, Pett Level (R. Tate); Hastings district (Hastings Phil. Soc., second suppl.); Brighton district (Mrs. Merrifield).

P. pusillum, Gmelin.—Widely distributed.

P. cinereum.—Apparently very rare. A single record. Dried-up ditch at Chidham, 1911 (Rev. W. A. Shaw).

P. nitidum, Jenyns.—A local species. Near Hastings and Guestling (Hastings Phil. Soc.); ditches at Lewes, Henfield, and Eastbourne (W. C. Unwin); deep ditches and pits at Chidham (W. Jeffery); Surrey and Sussex Canal, near Alfold (E. W. S.).

P. obtusale, Pfeiffer.—Locally abundant. Brighton district (Mrs. Merrifield); Lewes (W. C. Unwin); streams at back of Southover Crescent, Lewes (Lewes Nat. Hist. Soc.); Warbleton (F. H. Sykes); Pannell's Hole, Harting (W. Weaver); Burton, near Petworth (W. Jeffery).

P. gassiesianum, Dupuy (= *P. roseum*, Jeffreys).—A local species. Hastings (Rev. E. N. Bloomfield); Pevensey Marshes (Rev. W. A. Shaw and L. E. Adams); Chidham (Rev. W. A. Shaw).

In concluding this catalogue of the land and freshwater Mollusca of Sussex, I wish to express my thanks to the following conchologists for much kind help in its preparation:—The Revs. C. E. Y. Kendall and W. A. Shaw, Messrs. E. A. Butler, W. Ruskin Butterfield, E. Collier, H. L. F. Guernonprez, J. H. A. Jenner, D. Taylor, H. Toms, and W. Whitwell; and to Messrs. H. D. Gower and W. H. Thornton for photographs.

I must also acknowledge my indebtedness to Mr. J. W. Taylor's elaborate and indispensable Monograph for many records, chiefly concerning the *Testacellidæ*, *Limacidæ*, *Zonitidæ*, and *Arionidæ*.

NOTES AND QUERIES.

MAMMALIA.

Weasel Feeding upon Frogs.—Noticing a Weasel that was evidently interesting itself in a three months' old pullet that was wandering about my orchard, my son and I decided to watch for further developments. The Weasel stalked the chicken by working from behind a large pear tree, up to within some ten feet of it. Here it seemed to decide that its quarry was too large for its further attentions, and it returned nearer to where we stood. Here for fully a minute it gambolled about in a most remarkable way, and in one action apparently turned a complete somersault in the air. It then came to within a few feet of us, and proceeded to work a patch of coarse grass, and eventually pounced upon a victim, which action was accompanied by a squeal, but whether uttered by the Weasel in its excitement, or its prey, we could not satisfy ourselves. It quickly emerged carrying a full-grown Frog in its mouth, and made its way to a hole in the root of one of the orchard trees, but we succeeded in making it drop the Frog before it gained the entrance. The Frog had been seized across the back, just behind the head, and was apparently dazed with fright, as it took some time to recover its activity. We eventually killed the Frog and placed it near where the Weasel had left it, whence it was soon after removed.—J. STEELE ELLIOTT (Dowles Manor, Salop).

Albino Water-Vole in North Notts.—On September 7th through the kindness of a friend I had the pleasure of adding a albino Water-Vole (*Microtus amphibius*) to my collection, which was obtained locally; he was walking by the side of a stream when the Vole came out of its burrow and swam across the stream; its burrow was easily found, and was just level with the water. He stopped the entrance with a stone, and waited results; the Vole shortly returned, and in the attempt to regain its burrow, it became entangled in the water-weeds that were on the surface of the water close to its burrow, and was then easily captured. An albino specimen was killed by a shot from a catapult on the same stream, not far from the place where the one under notice was obtained, but the person who obtained it cut off all the feet and made a flat skin of it, and converted it into a little mat for his dressing-room table.—WILLIAM DAWS (Mansfield, Notts).

The Grey Squirrel in Bucks and elsewhere.—The note by Mr. Aplin in your current issue (p. 354) adds another English locality to the records of this species. The occurrence of a single individual is not of much consequence, but Whaddon Chase, the locality named, is likely to share in any spread of the species, as Bucks and Beds are two of the counties in which the Grey Squirrel has run wild for some years. See some particulars in the accompanying reprint.* To the localities named therein I am now able to add Norfolk and also near Manchester, but cannot say what success has followed the introductions there.—HUGH BOYD WATT.

Cats with Abnormal Tastes.—From time to time one meets with or hears of Cats with strange and abnormal tastes in the matter of diet. Many instances of vegetarian Cats, like the Persian mentioned by Miss Holloway ('Zoologist,' August, 1915, p. 316) have found their way into natural history journals and magazines, while other equally remarkable cases of this, and other vagaries of feline appetite, have probably never been recorded. Some Cats have a distaste for milk, and others care but little for meat or even refuse it altogether. A writer in the 'Field' of October 25th, 1890, gives an account of a Cat which preferred raw potatoes to meat, and was once discovered dragging a large cucumber from the dining-table in preference to a lamb cutlet, equally within his reach. This Cat had been seen also to eat mushrooms, stalk and all. In the same paper, under date of August 6th, 1881, mention is made of a Persian tom which used daily to eat two raw potatoes which were cut up for his special benefit. Besides asparagus, raw potatoes, and cucumbers, Cats have been known to devour raw carrots and turnips, cabbages, broccoli, seakale, tomatoes, vegetable marrows, melons, and even coconuts and preserved olives.† A vegetarian Cat belonging to Mr. A. H. Keane, is stated by him, in the 'Field' of August 23rd, 1881, not only to have been fond of raw potatoes, tomatoes, and vegetable marrows, but also to have been in the habit of searching the dust-bin for the marrow seeds, of which he was very fond. A Manx Cat we once had used to steal baked pears whenever he could get at

* In this, an interesting summary of the history of the Grey Squirrel in Britain, published in the 'Field' for June 12th of the present year, Mr. Boyd Watt gives as localities for colonies, besides several London ones and those in Bucks and Beds, Scampston Hall, Billington, in Yorks, and a territory twenty miles by five in Dumbarton. In Ken Wood, Hampstead, the Grey and Red Squirrels, it seems, live together "in some numbers."—ED.

† See the 'Field,' August 6th, 1881.

them, carrying them off to enjoy quietly by himself. We once had here a most useful rat-catching Cat of the ordinary short-haired breed, a member of a family of tortoiseshells, noted for their skill and prowess in that particular line. I one day found her crouching on the ground, devouring what seemed from her manner to be some unusually choice morsel, and growling over it as a Cat does with a mouse or bird. On going to see what she had caught, I found her eating a very large earthworm. The daughter of this Cat—a fine large tortoiseshell and white, had also peculiar tastes. Though of a quiet home-loving disposition, and not prone at other times to stray far from the house and garden, she had a habit of going off at times to a swampy piece of ground in order to catch and eat frogs. In the spring she would stand at the edge of a pond and eat the frogs' spawn which she dragged out of the water. I have also seen the same Cat feeding on a fungus growing in a plantation near the house which I believe to be *Agaricus procerus*, the parasol agaric. This species seems to be relished by other animals besides Cats, as it sometimes shows marks of the teeth of small rodents of some kind. This summer (1915) a small and very inconspicuous fungus, which I have as yet been unable to identify, appeared here in a kitchen garden about the strawberry and raspberry beds in particular, and had extraordinary attractions for some of our Cats. It had a rounded cap, and was of a dark smoky brown or dingy grey colour, not unlike that of the soil upon which it grew. For several weeks, in fact as long as any of the fungi could be found, two of our Cats used to go almost daily to search for them, carefully examining the places where they were wont to make their appearance, and showing much excitement at each "find." Curiously enough the other Cats would neither eat nor take much notice of them.—G. T. ROPE.

A V E S.

Albino Pheasant.—For years I have been on the look-out for a true albino Pheasant, but met with no success until last Christmas time, when I fortunately secured a specimen from a local game dealer; it was killed on the Welbeck Abbey Estate. It is a fine male with pink eyes. I might say that a good number of white Pheasants have passed through my hands, but this is the only true albino that I have seen so far, with the pink eyes; the colours of the eyes of the other white Pheasants that I have examined have ranged from lemon-colour to light brown. I shall be on the look-out this coming Pheasant-shooting season for a female albino, to go with the male already in my collection.—WILLIAM DAWS (Mansfield, Notts).

Dunlin in North Notts in Summer Plumage.—On May 13th, 1915, a friend brought me a Dunlin (*Tringa alpina*) that had that morning flown into a workshop just outside Mansfield; it made a dash for the skylight in its attempt to regain its liberty, but it struck its head with such force that it fractured its skull and died directly. It is a male in summer dress; it is very unusual to obtain them in their breeding-dress in this district. I am not aware of the Dunlin breeding in North Notts, but we frequently see them in small parties in the autumn, particularly when the water in the local reservoirs is low and exposes a fair quantity of mud for them to explore for food.—WILLIAM DAWS.

Little Owls in North Notts.—The Little Owl (*Carine noctua*) appears to be increasing rather rapidly in this district (Mansfield) the last year or two; I have heard of a fair number being shot. Some were said to be young Owls, but by the description given, in several cases, there is no doubt that several of them were Little Owls. I have had three sent me recently, the last on August 28th. One man complained about their destruction of his game chicks by daylight; he said one of them was a regular pest, as it was taking these chicks day after day. The first time he saw it, he thought it was a male Sparrow-Hawk, but he waited in ambush for it, and when it fell to his gun it proved to be a Little Owl.—WILLIAM DAWS.

Stock-Dove Breeding in a Church-Tower.—On August 21st, as I was passing through our churchyard, a Stock-Dove flew out of the hole in the tower which earlier in the year had been occupied by Tawny Owls, and when I went up I found a nest with two eggs. One of these was a failure, but the other hatched, and to-day (September 30th) the young bird was thriving and nearly fit to fly. He is an amusing little chap, snapping his beak at an intruder like an owlet, and striking with his wing at a hand put near him; in fact, I do not touch him now for fear of his breaking his wing against the stone. I have only seen one nest in the tower before, and that was in the same hole many years ago. There are still (or were a few days ago) two young Stock-Doves in one of our boxes, and two eggs, which looked almost fresh, in another. This bird is our earliest and also our latest breeder; I have seen eggs in February.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds, Suffolk).

Mandarin Duck Feeding in a Tree.—On Sunday, September 12th, I saw a Mandarin Drake (*Aix galericulata*) which was hatched last year at the Zoo and has fortunately escaped pinioning, fly from a low fence into a small oak-tree in which some Wood-Pigeons were feeding on the green acorns; I then saw him pulling at the leafy twigs

from the branch on which he stood, and though I cannot say for certain he was eating the acorns, I presume that this was what he was doing, as I afterwards saw him fly to another bough, no doubt to get a more favourable position for picking them, and on the following Sunday I again saw him behave in exactly the same way.—F. FINN.

Hobby in Petersfield District.—I am sorry to record the death of a fine old male Hobby which was shot here during July last whilst it was ranging a field where there happened to be some Pheasant coops. This is the only Hobby I have ever seen in this locality.—(Rev.) H. MARMADUKE LANGDALE (Compton, Petersfield).

PISCES.

Colour-change in Fish.—That not only Tench, but probably all species of freshwater fish without exception (certainly most British species), involuntarily change colour so as to harmonize with the bottom of the stretch of water they frequent, must have been known ever since people first began to keep fish in confinement, not only in glass aquaria, but in any artificially circumscribed basin. I have not forgotten my astonishment fifty or more years ago, when, having temporarily placed a mixed lot of fish (Roach, Dace, Gudgeon, and probably two or three other species, but I cannot recollect with certainty) in a white bath, where they were of course very conspicuous, I found, after a short time (perhaps less than an hour, but certainly under two), that they had all become quite pale and inconspicuous. Since then I have seen the same change and its reverse over and over again, so that I should no more have thought of noting it than the apparent fact that the sun rises and sets every day. Whether sea-fish have the same power of unwittingly changing colour I do not know, but as the large majority inhabit such much deeper water, they may have no need for this provision; but as Mr. Milligan has sea-water aquaria, he has a chance of making observations which, even if they should prove not to be new, would be so at any rate to me.—ALFRED H. COCKS (Poynetts, Skirmett, near Henley-on-Thames).

INSECTA.

Hornet's Nest in the Ground.—In reference to the Rev. Julian G. Tuck's note in the 'Zoologist' for August, p. 320, I once saw a Hornet's nest in a low hedge-bank by the roadside at Framfield, Sussex. I have no recollection of ever having seen another in the ground. I doubt if a Hornet has been seen by me in this district for over thirty years.—ROBERT MORRIS (Uckfield, Sussex).

NOTICES OF NEW BOOKS.

Spencer Fullerton Baird. By WILLIAM H. DALL, D.Sc. Philadelphia and London: J. B. Lippincott Co. 1915. 15s. net.

IN this handsome and copiously illustrated work, Dr. Dall gives us a most interesting biography of the late Professor Baird, formerly head of the Smithsonian Institution, a distinguished naturalist of very wide zoological interests, with that practical bent of mind and amiability of character which seem so often to distinguish American zoologists. Perhaps the economic work they have to do may have something to do with this; Professor Baird, in particular, distinguished himself in connection with the attempts of the United States Fish Commission, of which he was the first chief, to increase the supply of food fishes, which have been, in many cases, crowned with success; as in the cases of the re-population of the Pacific Coast Salmon-grounds by hatcheries, and successful transference of the Shad from the Atlantic Coast to the Pacific, where it is now a market staple, while "the inshore Cod-fishery of New England was measurably restored." Yet, as we are told, "so great a zoological authority as Huxley, appointed to a somewhat similar board of inquiry in regard to the North Sea Fisheries of Great Britain, had no hesitation in declaring that no actions of man could have the power either to increase or perceptibly diminish the quantity of fishes in the sea; and that all such changes were due to causes beyond human foresight or control." Although a great museum official, however, and a teaching Professor of great note, Baird was always a good deal of a field naturalist and keeper of live animals, as the copious extracts from his correspondence with Audubon, Dana, Agassiz, and others, which vary these pages, abundantly prove; and field naturalists, like fanciers, learn, or should learn, to be very careful in talking about zoological "impossibilities." A quaint bit of folklore about the Scottish ancestors of the Professor's family deserves quoting: Thomas the Rhymer had prophesied that there "would always be an eagle in the crags of Pennan while there was a Baird in Auchmedden," and the birds supported the bard loyally, disappearing when the Earl of Aberdeen purchased the estate, to return when his eldest son, Lord Haddon, married a Miss Baird, and depart again when

the estate changed hands a second time. "In the presence of these curious facts, attested by many witnesses, the people in the neighbourhood, when the estate was acquired in 1854 by Mr. Robert Baird, became curious to see whether the eagles would return. In particular the Rev. Mr. Gardiner, the then minister of the parish, was on the look-out. Strange to say they did return to their old eyrie, and continued there for some time "till driven away for good by being shot at by the Pennan coastguards."

The Amateur Menagerie Club Year Book, 1915. Edited by
G. TYRRWHITT-DRAKE.

THE present little volume is far the best of these year-books we have seen, and should be in the hands of everyone who is interested in animals and has anything to do with their practical management in captivity, as it contains much information of scientific value and an unusual number of practical hints. Dr. Hornaday, of the New York Zoological Park, gives a full account of the young female Gorilla under his charge, and now thriving, after recovery from a serious illness. We note with interest that a large portion of her food is human diet—a restaurant dinner, in fact; such feeding suits anthropoids well, as we have often observed in the case of those kept in the Hamlyn establishment. Sir Claud Alexander's "Notes for Novices" are invaluable, for he enters into the most minute details as to the practical management of both carnivorous and herbivorous mammals, especially as regards the all-important point of feeding. He is quite contented with very modest housing, his own dens being "old showmen's waggons," and prefers boarded floors to stone ones. There seems to be in progress a feeling for simplicity in exhibitions of animals, for we find Dr. Renshaw declaring, what we have often remarked ourselves, that "the chief bane of zoological collections may be summed up in two words—architecture and horticulture." We do not, however, agree with his recommendation of green paint for wirework; we think it dangerous, and tar-varnish is much better. Mr. R. Scott Miller gives an interesting account of his success in breeding Raccoons; his accommodation was most simple—a corrugated iron lean-to 9 ft. deep by 5 ft. wide and 6 ft. 6 in. at the eaves, with branches and a barrel. Miss E. Chawner has valuable notes on the small

South African Chamæleon (*Chamæleo pumilus*), which she has several times bred; the young, it seems, have a curious habit of eating bits of their cast skins, and have little power of colour-change.

There are other interesting notes which space forbids us to mention, and very numerous illustrations, most of them to our thinking rather unnecessary; but the Duchess of Bedford's photograph of a Mule between a Grévy's Zebra stallion and a large Spanish Ass (also shown) is of great interest, indicating this hybrid to be well striped, whereas a hybrid between the Somali Ass (a race of *Equus asinus*) and a mare of the Mountain Zebra bred at the Zoo is nearly devoid of stripes except on the legs and shoulders.

Typical Flies. By E. K. PEARCE. Cambridge University Press.
1915. 5s. net.

THIS is a photographic atlas of typical Diptera, including the Aphaniptera or Fleas. The photographs are admirably clear and have useful short notes under them. The preface contains practical hints on collecting and preservation, and Brauer's classification of the order is also given. The work should be of great value to those beginning the study of this important and difficult group of insects.

Mind in Animals. By E. M. SMITH. Cambridge University Press. 1915. 3s. net.

THIS manual deals with the various manifestations of animal intelligence and instinct, from the simple reactions of the Protozoa to the complex minds of such high mammals as Monkeys. There are special chapters on Instinct, Homing, Imitation, and other topics, and much valuable information is given. Some of the methods by which experimenters have sought to gauge animal intelligence seem to us not very creditable to their own; we do not see that much is gained by testing the abilities of animals to find their way out of absolutely unnatural difficulties as models of the Hampton Court Maze, the original being admittedly a poser for many human beings, and we quite agree with the author's criticism of the puzzle-box method of research, in which a hungry animal is shut up and forced to find a way out of its prison, such as by lifting a latch, before getting at food. "The hungry animal," it is rightly said, "in close

confinement, is in a mood far from that state of calm collectedness favourable to the scientific examination of a novel situation. Nor should it be lost sight of that though the particular action required may not be strange, yet taken in its near connection it is, presumably, entirely foreign to the subject, and about as meaningless as a camera or combination letter-lock would be to an unsophisticated Patagonian."

Through Western Madagascar. By WALTER D. MARCUSE.
London: Hurst & Blackett. 1914. 7s. 6d. net.

THOUGH largely devoted to the question of the exploitation of commercial products, especially the American Lima or butter bean (*Phaseolus limensis*), which has been acclimatized in Madagascar, and is there cultivated with extraordinary success, this book, most interestingly written, contains many notes of interest on the fauna of an island one does not hear much about as a rule. For instance, we are told of the wild cattle of the Menabé country, estimated as at least 20,000 head, that a friend of the author's, an old resident of the country, "is of the opinion that they show a slight strain of the Zebu, and tells me that in some of the specimens shot by him the faintest trace of a hump is discernable." Now, as our author mentions, and as one of the excellent photographic illustrations shows, the tame cattle of Madagascar are typical humped Zebus; does his friend's observation mean that the wild animals breed with tame, and are themselves of European stock, or does the humped breed when wild lose the hump and assume the characters of ordinary cattle? We may mention that in India, the home of the Zebu breed, humpless specimens are common. The note that in handling a wounded White-faced Tree-Duck (*Dendrocygna viduata*), one has to look out for scratches, reminds one of Colonel Hawker's well-known remark about a wounded Coot; this Duck is extraordinarily like a Coot in contour and in its springing method of diving, so that it is interesting to find it has evolved the same method of defence. Crocodiles, it seems, are still the terrors of Madagascar, being dreaded man-eaters; native legends credit the Cormorants, which our author says feed chiefly on the fresh-water snail (*Melanatria johnsoni*), with watching over and warning these reptiles against man.

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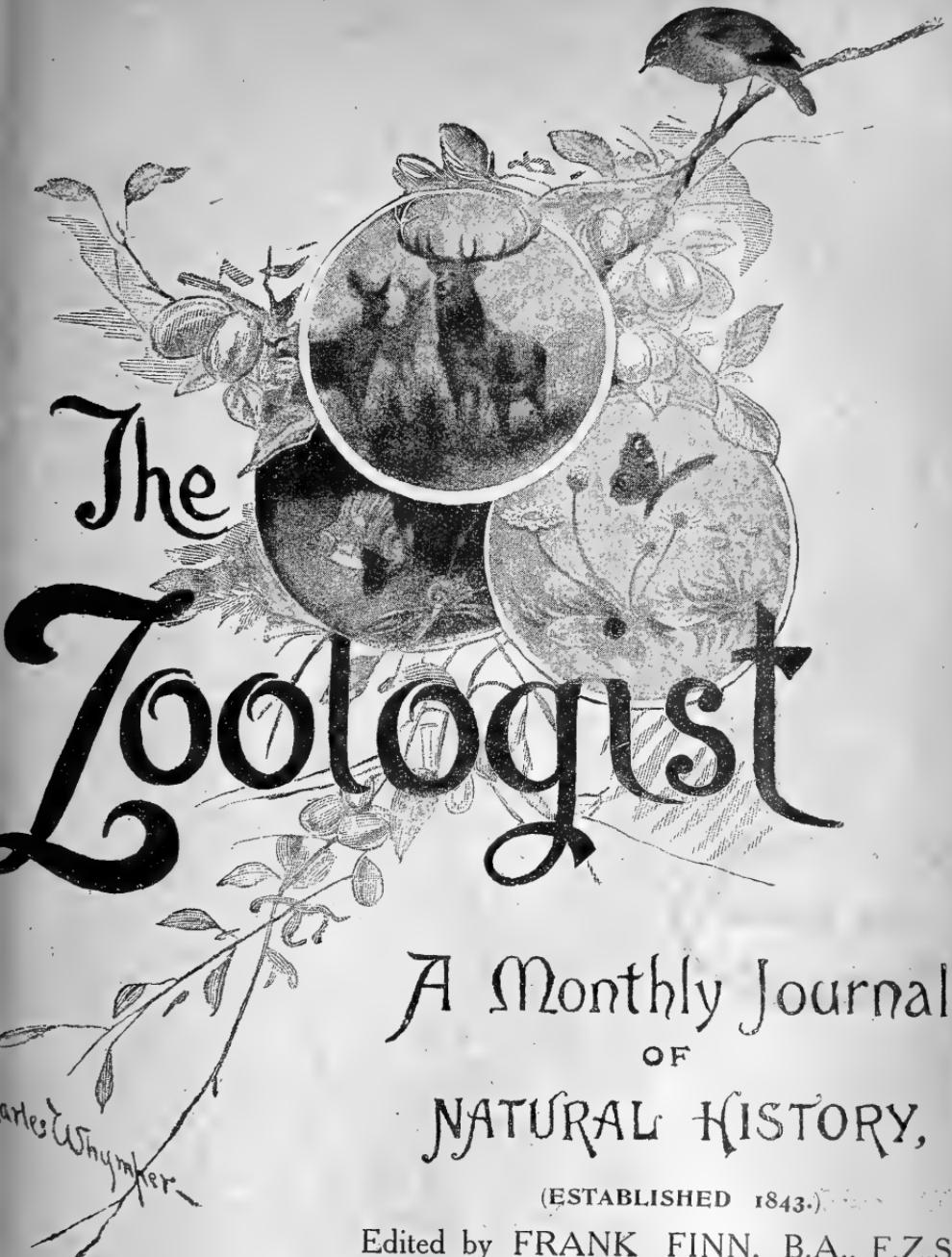
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THE ZOOLOGIST

No. 893.—*November 15th. 1915.*

PLEISTOCENE AND LATER BIRD FAUNA OF GREAT BRITAIN AND IRELAND.

BY ALFRED BELL.

It may be of service to those interested in the history of the avifauna of Great Britain and Ireland to have for reference a digest of the scanty records of former bird-life left in the dens, caves, fens, clays, marshes, and river alluvia of these kingdoms, and in the shell mounds and refuse-heaps of our stone-using forerunners, and in the Celtic lake-dwellings, and on Romano-British dwelling-places.

Caves, as may be inferred, are the richest depositories of these remains. In those where the bones occur in two distinct layers or strata, these have a tendency to become intermixed, owing to the burrowing habits of Rabbits, Badgers, and Foxes. To the same animals and the Wild Cats we are probably indebted for the presence of the Common Fowl, Goose, Duck, and Pheasant, birds introduced by our Celtic and Roman invaders. The last newcomer, the Turkey, is more common in Ireland than in England, occurring in the upper layers of nearly every Irish cave deposit.

Very few birds are quoted from the older bone-caves of Derbyshire or of the south-west coast, so rich in the larger mammalia. It would seem from the success that has attended later workers that the rarity was due to a looser method of examining the cave débris rather than to their absence, as the early caves of Ballynamintra, Shandon, Castlepook, are all more or less productive.

Palæo-zoologists and ornithologists owe much to Mr. E. T. Newton, F.R.S., who has spared neither time nor trouble in the task of deciphering the hundreds if not thousands of bones submitted to him. It may be said that of the many caves referred to,* there are only a few, and those of the earlier period, whose relics have not been through his hands. For my own part I have gratefully to acknowledge the help and assistance he has been to me in this paper and at other times.

Mr. A. S. Kennard, F.G.S., who is now investigating a richly fossiliferous fissure cave at Chudleigh (not McEnery's cave), has kindly permitted me to use his MS. list of birds, determined by Mr. Newton. The opening to the cave, which has been used as the eyrie of some small bird of prey for some years, is now some thirty feet above beach, but must formerly have been more accessible, as the bones of Pig, Ox, and Red Deer suggest human occupation. The mammalian bones now under examination contain the Tailless Hare (*Pika*), and carry it back to Mid-Pleistocene Age.

The bird bones from the Mammoth Cave at Castlepook, near Doneraile, Co. Waterford, are in hand, and a list will be published in due course.

The writer's thanks are due to Messrs. J. H. Gurney, Kennard, Jackson, Dr. Scharff, and the late R. T. Ussher, Rev. E. H. Mullins, Dr. Male, and many other friends, who have furnished him with much information and help in making the list so complete.

POST-TERTIARY BIRDS.

MISTLE-THRUSH (*Turdus viscivorus*, L.).—*Caves*: Wye Valley, Chudleigh; ? Grimes Graves. *Ireland*: Doneraile, Kesh, Edenvale.

SONG-THRUSH (*T. musicus*, L.).—*Caves*: Clevedon, Chudleigh, Langwith Bassett, Ightham. *Ireland*: Kesh, Edenvale, Bantick, Newhall.

REDWING (*T. iliacus*, L.).—*Caves*: Clevedon, Chudleigh, Longcliffe, Langwith Bassett. *Ireland*: Kesh (Plunkett), Edenvale, Bantick, Newhall.

* The reader is referred to the Appendix for papers containing detailed information on the different caves, &c., and their contents, which have furnished the present material for this article.

FIELDFARE (*T. pilaris*, L.).—*Caves*: Ireland: Kesh and Edenvale.

BLACKBIRD (*T. merula*, L.).—*Caves*: Clevedon, Chudleigh, Langwith Bassett, Ightham. Ireland: Doneraile, Edenvale, Newhall, Kesh.

WHEATEAR (*Saxicola oenanthe*, L.).—*Caves*: Clevedon, Langwith Bassett, Ightham.

WHINCHAT (*Pratincola rubetra*, L.).—*Caves*: Carnforth, Chudleigh. Ireland: Kesh.

REDSTART (*Ruticilla phoenicura*, L.).—*Caves*: Chudleigh.

REDBREAST (*Erithacus rubecula*, L.).—*Caves*: Clevedon, Chudleigh, Longcliffe, Langwith Bassett. Ireland: Kesh, Newhall, and Edenvale.

NIGHTINGALE (*Daulias luscinia*, L.).—*Caves*: Langwith Bassett.

WHITETHROAT (*Sylvia cinerea*, Bechst.).—*Caves*: Chudleigh.

HEDGE-SPARROW (*Accendor modularis*, L.).—*Caves*: Chudleigh, Langwith Bassett, Ightham. *Roman*: Caerwent.

DIPPER (*Cinclus aquaticus*, Bechst.).—*Caves*: Chudleigh.

COAL-TIT (*Parus ater britanicus*, S. & D.).—*Caves*: Chudleigh.

BLUE TIT (*Parus caeruleus*, L.).—*Caves*: Carnforth.

NUTHATCH (*Sitta cæsia*, Wolf.).—*Caves*: Chudleigh, Langwith Bassett.

WREN (*Troglodytes parvulus*, K. L. Koch).—*Caves*: Chudleigh.

TREE-CREEPER (*Certhia familiaris*, L.).—*Caves*: Chudleigh.

PIED WAGTAIL (*Motacilla lugubris*, Temm.).—*Caves*: Langwith Bassett, Chudleigh, Ightham. Ireland: Kesh (upper level), Edenvale (both levels).

MEADOW-PIPIP (*Anthus pratensis*, L.).—*Caves*: Langwith Bassett, Chudleigh, Ightham. Ireland: Kesh (top level).

ROCK-PIPIP (*A. obscurus*, Lath.).—*Caves*: Langwith Bassett, Chudleigh.

RED-BACKED SHRIKE (*Lanius collurio*, L.).—*Caves*: Ightham fissure.

SWALLOW (*Hirundo rustica*, L.).—*Caves*: Langwith Bassett, Ightham. Ireland: Kesh (both levels).

HOUSE-MARTIN (*Chelidon urbica*, L.).—*Caves*: Carnforth. Ireland: Newhall (top level).

GREENFINCH (*Ligurinus chloris*, L.).—*Caves*: Clevedon, Chudleigh. Ireland: Kesh.

HAWFINCH (*Coccothraustes vulgaris*, Pall.).—*Caves*: Chudleigh.. Ireland: Newhall (top level).

GOLDFINCH (*Carduelis elegans*, Steph.).—*Caves*: Chudleigh.

HOUSE-SPARROW (*Passer domesticus*, L.).—*Caves*: Langwith Bassett, Chudleigh, Ightham. Ireland: Kesh, Edenvale (top levels).

CHAFFINCH (*Fringilla cœlebs*, L.).—*Caves*: Langwith Bassett, Ightham. Ireland: Kesh.

LINNET (*Acanthis (Linota) cannabina*, L.).—*Caves*: Chudleigh. Ireland: Kesh (Plunkett).

BULLFINCH (*Pyrrhula europaea*, Vaill.).—*Caves*: Ireland: Edenvale, Newhall (top levels), Kesh (lower levels).

CORN-BUNTING (*Emberiza miliaria*, L.).—*Caves*: Chudleigh.

YELLOWHAMMER (*E. citrinella*, L.).—*Caves*: Chudleigh. Ireland: Newhall.

STARLING (*Sturnus vulgaris*, L.).—*Caves*: Chudleigh. Ireland: Bantick (Co. Sligo), Edenvale and Newhall (Clare), Knockmore and Knocknanny (Fermanagh), ? Grimes Graves.

CHOUGH (*Pyrrhocorax graculus*, L.).—*Caves*: Chudleigh.

JAY (*Garrulus glandarius*, L.).—*Caves*: Ireland: Kesh, Edenvale, Newhall.

MAGPIE (*Pica rustica*, Scop.).—*Caves*: Ireland: Castlepook, Edenvale, Newhall.

JACKDAW (*Corvus monedula*, L.).—*Caves*: Langwith Bassett, Chudleigh. Ireland: Kesh (top level), Edenvale, Newhall.

RAVEN (*C. corax*, L.).—*Caves*: Kirkdale, Clevedon, Langwith Bassett. Ireland: Shandon, Edenvale, Newhall, Bantick. Scotland: Linlithgow. *Roman*: Caerwent, Cranbourn Chase, Woodcuts, Lewes (Mount Caburn).

CARRION-CROW (*C. corone*, L.).—*Sub-Arctic* ?: Dalling (Norfolk), Hastings (Kit. midd.). *Celtic*: Glastonbury.

ROOK (*C. frugilegus*, L.) or CROW.—*Caves*: Langwith Bassett. Ireland: Castlepook, Kesh (Plunkett), Edenvale, Newhall, Bantick.

SKY-LARK (*Alauda arvensis*, L.).—*Caves*: Kirkdale, Clevedon, Langwith Bassett, Chudleigh, Ightham. Ireland: Castlepook. *Celtic*: Barton Mere.

? SHORE-LARK (*Otocorys alpestris*, Jenym.).—*Caves*: Chudleigh.

GREAT SPOTTED WOODPECKER (*Dendrocopos major*, L.).—*Caves*: Langwith Bassett, Chudleigh. Ireland: Edenvale, Newhall, (top level).

SWIFT (*Cypselus apus*, L.).—*Caves*: Clevedon.

BARN-OWL (*Strix flammea*, L.).—*Caves*: Ireland: Edenvale (top level). *Celtic*: Glastonbury. *Roman*: Cranbourn Chase, Woodcuts.

SHORT-EARED OWL (*Asio accipitrinus*, Pall.).—*Cave*: Longcliffe.

TAWNY OWL (*Syrnium aluco*, L.).—*Cave*: Langwith Bassett.

LITTLE OWL (*Athene (Carine) noctua*, Scop.).—*Cave*: Chudleigh.

SNOWY OWL (*Nyctea scandiaca*, L.).—*Cave*: Kents Hole.

EAGLE OWL (*Bubo ignavus*, T. Forster).—*Forest-bed*: E. Runton. *Cave*: Langwith Bassett.

BUZZARD (*Buteo vulgaris*, Leach).—*Caves*: Brixham, Clevedon, Ightham.

EAGLE sp.—*River-gravels*: Swanscombe, Kent. *Caves*: Ravencliff, Langwith Bassett, Ightham, Little Hoyle (Neolithic).

GOLDEN EAGLE (*Aquila chrysaëtus*, L.).—*Cave*: Perthichwareu (*fide* Boyd-Dawkins).

WHITE-TAILED SEA EAGLE (*Haliaëtus albicilla*, L.).—*Cave*: Clevedon. *Fenlands*: Burwell. *Celtic*: Glastonbury.

GOSHAWK (*Astur palumbarius*, L.).—*Celtic*: Glastonbury.

SPARROW-HAWK (*Accipiter nisus*, L.).—*Caves*: Ireland: Newhall (top level).

KITE (*Milvus ictinus*, Savigny).—*Celtic*: Glastonbury.

PEREGRINE FALCON (*Falco peregrinus*, Tunst.).—*Cave*: Ightham. Ireland: Neolithic in sandhills, Whitepark Bay.

KESTREL (*F. tinnunculus*, L.).—*Cave*: ? Chudleigh. Ireland: Kesh (Plunkett, top level).

OSPREY (*Pandion haliaëtus*, L.).—*Peat*: Walthamstow.

CORMORANT (*Phalacrocorax carbo*, L.).—*Forest-bed*: W. Runton. *Caves*: Clevedon. Ireland: Newhall, Ballingtoy. Pleistocene: Grays Thurrock (Essex). Scotland: *Azilian*: Cnoc-sligeach, Oransay, Kit. midd., Caithness. *Celtic*: Ulrome, Holderness, Glastonbury.

SHAG (*P. graculus*, L.).—Scotland: Shell-heaps or Kit. midd., Oransay, Caithness.

GANNET (*Sula bassana*, L.).—Neolithic: Whitburn (Durham).

Ireland: Whitepark Bay. Scotland: Colonsay, Oransay, Caithness, Orkney, Ardrossan.

PELICAN (*Pelicanus crispus*, Bruch.).—*Fenlands*: King's Lynn, Burwell, Fulwell and Burnt Fen. *Celtic*: Glastonbury.

HERON (*Ardea cinerea*, L.).—*Caves*: Clevedon. Ireland: Ballycotton, Edenvale, Newhall (top level). *Celtic*: Glastonbury.

BITTERN (*Botaurus stellaris*, L.).—*Peats*: Burwell and Reachfens. *Celtic*: Glastonbury.

WHITE STORK (*Ciconia alba*, Bechst.).—*Roman*: Silchester.

GREY LAG-GOOSE (*Anser cinereus*, Meyer).—*Forest-bed*: W. Runton. *Caves*: Langwith Bassett, Chudleigh, Ightham. *Pleistocene brick-earths*: Grays, Ilford, Lawford, Fisherton. *Fenlands, passim*: Scotland: Kit. midd., Ardrossan, Dalry. *Celtic* species in barrow: Stonehenge. Glastonbury, sp. indet. *Roman*: Silchester. (Eggs have been found in brick-earth at Fisherton near Salisbury).

WHITE-FRONTED GOOSE (*A. albifrons*, Scop.).—*Caves*: Langwith Bassett. Ireland: Kesh (Plunkett, both levels), Edenvale, Newhall.

BEAN GOOSE (*A. segetum*, Gmel.).—*Caves*: Kents Hole, Brixham. Ireland: Shandon.

BARNACLE GOOSE (*Bernicla leucopsis*, Bechst.).—*Cave*: Ireland: Shandon.

BRENT GOOSE (*B. brenta*, Pall.).—*Caves*: Kirkdale, Clevedon. *Peat*: Walthamstow.

DOMESTICATED or SEMI-FERAL GOOSE.—*Celtic*: Holderness, Glastonbury. *Roman*: Barton, Caerwent, Corbridge, Silchester.

WHOOPER SWAN (*Cygnus musicus*, Bechst.).—*Pleistocene brick-earths*: Grays, Ilford. *Peat*: Burwell and Southery Fens. *Celtic*: Glastonbury. *Caves*: Ireland: Dungarvan, Edenvale.

BERWICK'S SWAN (*C. bewickii*, Yarr.).—*Cave*: Ireland: Shandon. *Peat*: Newport, Mons.

MUTE SWAN (*C. olor*, Gmel.).—*Fens*: near Cambridge. *Cave*: Ireland: Castlepook.

(POLISH SWAN (*C. immutabilis*, Yarrell).—Southery Fen (Brit. Mus. Cat. Foss. Birds, p. 107), but it is a doubtful species at the best.)

TAME or SEMI-FERAL SWANS have been found in the Celtic village at Glastonbury, and on the Roman sites at Barton,

Corbridge, and Silchester. Ireland: Castlepook, probably recent.

SHELDUCK (*Tadorna cornuta*, S. G. Gmelin).—*Caves*: Kents Hole, Brixham. Ireland: Newhall, Bantick. Scotland: in shell mound, Ardrossan.

DOMESTIC DUCK.—Irish caves generally, and in most Celtic and Romano-British sites.

MALLARD or WILD DUCK (*Anas boscas*, L.).—*Pleistocene brick-earth deposits*: Grays Thurrock, Fisherton, Bielbacks (Yorkshire). *Caves*: Kirkdale, Clevedon, Wye, Chudleigh, Ightham. Ireland: Kesh, Bantick, Edenvale, Newhall in both levels. *Peat*: Burwell and Southery Fens, Withernsea, Walthamstow. *Celtic*: Ulrome, Glastonbury, St. Catherines, Isle of Wight. *Roman*: Caerwent, Settle, Silchester.

SHOVELLER (*Spatula clypeata*, L.).—*Forest-bed*: W. Runton. *Sub-Arctic*: Mundesley. *Cave*: Ightham fissure. *Celtic*: ? Glastonbury.

PINTAIL (*Dafila acuta*, L.).—*Cave*: Clevedon ? Ireland: Kesh (Coffey, low level), Newhall. *Celtic*: ? Glastonbury.

TEAL (*Querquedula crecca*, L.).—*Fens*: Cambridge, *passim*. *Celtic*: Glastonbury. *Roman*: Caerwent, Silchester. *Caves*: Ireland: Newhall (top level).

TERN (*Sterna fluviatilis*, L.).—Scotland: Kit. midd., Oransay.

WIGEON (*Mareca penelope*, L.).—*Cave*: Clevedon ? Ireland: Kesh, Edenvale, Newhall, Castlepook. *Celtic*: ? Glastonbury. *Roman*: Silchester.

POCHARD (*Fuligula ferina*, L.).—*Forest-bed*: Ostend. *Caves*: Ireland: Edenvale, Newhall (top level).

TUFTED DUCK (*F. cristata*, L.).—*Caves*: Ireland: Edenvale, Newhall (top level). *Celtic*: Glastonbury.

SCAUP-DUCK (*F. marila*, L.).—*Caves*: Ireland: Castlepook, Kesh (Plunkett, lower level). *Celtic*: Glastonbury.

? GOLDEN-EYE (? *Clangula glaucion*, L.).—*Celtic*: ? Glastonbury.

EIDER-DUCK (*Somateria mollissima*, L.).—*Arctic clay*: Scotland: Stratheden. *Cave*: Ireland: Shandon.

COMMON SCOTER (*Edema nigra*, L.).—*Cave*: Ightham fissure. Ireland: Kesh (Plunkett, lower level). Scotland: in red Arctic clay, Seaton, near Aberdeen.

SURF SCOTER (*O. perspicillata*, L.).—*Arctic Clay*: Scotland: Stratheden.

DUCK, sp. indet.—*Forest-bed*: Ostend.

RED-BREASTED MEGANSER (*Mergus serrator*, L.).—Lea Valley, Reach Fen. Scotland: Kit. midd., Oransay, Ardrossan. *Celtic*: Glastonbury.

SMEW (*M. albellus*, L.).—*Caves*: Chudleigh. Ireland: Kesh (Coffey, low level). *Peat*: Reach Fen.

WOOD-PIGEON (*Columba palumbus*, L.).—*Caves*: Langwith Bassett, Chudleigh. Ireland: Edenvale, Newhall (both levels).

STOCK-DOVE (*C. ænas*, L.).—*Cave*: Kirkdale.

DOMESTIC PIGEON (*C. livia*, J. F. Gmelin).—*Caves*: ? Langwith Bassett, Chudleigh. Ireland: Edenvale, Newhall, Ballintoy. *Peat*: Newport (Mons.). *Roman*: Caerwent, Silchester.

CAPERCAILLIE (*Tetrao urogallus*, L.).—*Forest-bed*, *Arctic*: Ostend. Teesdale.

BLACK GROUSE (*T. tetrix*, L.).—*Caves*: Kents Hole, Kirkdale, Little Hoyle (Gower). Scotland: Assynt. *Peat*: Newport (Mons.), Kit. midd., Hastings. *Roman*: Corbridge, Settle.

RED GROUSE (*Lagopus scoticus*, Lath.).—*Caves*: Langwith Bassett, Wye, Chudleigh. Ireland: Shandon, Edenvale (lower level), Kesh. Scotland: Kit. midd., Ardrossan and Assynt. *Roman*: Settle.

PTARMIGAN (*Lagopus mutus*, Montin).—*Caves*: Langwith Bassett, Chudleigh. Ireland: Ballynamintra, Kesh (low level) (Plunkett, Coffey).

PHEASANT (*Phasianus colchicus*, L.).—*Caves*: Langwith Bassett, Chudleigh. Ireland: Plunkett, Newhall, Bantick, Edenvale (top). *Roman*: Barton, Corbridge, Silchester. Scotland: Ardrossan.

PARTRIDGE (*Perdix cinerea*, Lath.).—*Caves*: Kirkdale, Langwith Bassett, Wye, Chudleigh. Ireland: Edenvale, Newhall. *Roman*: Barton, Corbridge, Silchester.

QUAIL (*Coturnix communis*, Bonat.).—*Cave*: Chudleigh. Ireland: Castlepook, Newhall (top level).

DOMESTIC FOWL (*Gallus bankiva*, Temm.).—*Caves*: Langwith Bassett, Chudleigh, Berry Head. Ireland: Castlepook, Kesh, Bantick, Edenvale, Newhall. *Celtic*: Barton, Castleton, Glastonbury. *Roman*: Caerwent, Settle, Silchester, Lewes.

TURKEY (*Meleagris gallopavo*, L.).—*Caves*: Ireland: Done-
raile, Kesh, Edenvale, Newhall. *River alluvium*: Lea, North
London (Dr. Frank Corner Coll.). Located in England by
A.D. 1530; when introduced into Ireland is not known.

LAND-RAIL or CORN-CRAKE (*Crex pratensis*, Bechst.).—*Caves*:
Ireland: Kesh, Castlepook, Bantick, Newhall. *Celtic*: Glaston-
bury.

WATER-RAIL (*Rallus aquaticus*, L.).—*Caves*: Ightham. Ire-
land: Bantick, Edenvale, Newhall (top levels). Scotland:
Kit. midd., Oransay, Colonsay, Ardrossan.

MOORHEN (*Gallinula chloropus*, L.).—*Peat*: Burwell Fen.
Caves: Ireland: Castlepook, Edenvale, Newhall (top level).

COOT (*Fulica atra*, L.).—*Caves*: Gop (Prestatyn, N. Wales).
Ireland: Ballynamintra, Edenvale (top level). *Fens*: Cam-
bridgeshire, *passim*. *Celtic*: Glastonbury.

CRANE (*Grus communis*, Bechst.).—*Fens*: Burwell, King's
Lynn. *Celtic*: Glastonbury. *Roman*: Barton, Silchester.
Caves: Ireland: Edenvale, Newhall. Kit. midd., Ballycotton.

GREAT BUSTARD (*Otis tarda*, L.).—A doubtful find in Norfolk
peat.

RINGED PLOVER (*Ægialites hiaticula*, L.).—*Caves*: Clevedon,
Chudleigh. *Shell-heaps*: Cnoc-sligeach, Oransay (*Azilian*),
Kit. midd., Ardrossan.

GOLDEN PLOVER (*Charadrius pluvialis*, L.).—*Caves*: Clevedon.
Ireland: Edenvale (top level). *Roman*: Caerwent.

GREY PLOVER (*Squatarola helvetica*, L.).—*Cave*: Ireland:
Kesh (Coffey) (low levels). *Roman*: Silchester.

LAPWING (*Vanellus vulgaris*, Bechst.).—*Caves*: Chudleigh.
Ireland: Bantick, Edenvale, Newhall.

TURNSTONE (*Strepsilas interpres*, L.).—*Caves*: Clevedon.

OYSTERCATCHER (*Hæmatopus ostralegus*, L.).—Scotland: Kit.
midd., Ardrossan.

WOODCOCK (*Scolopax rusticula*, L.).—*Fen*: Swaffham. *Roman*:
Silchester. *Caves*: Ireland: Kesh (Coffey), Newhall (top layer).

SNIPE (*Gallinago cælestis*, Frenzel).—*Caves*: Kirkdale. Ire-
land: Edenvale, Newhall (both levels).

JACK-SNIPE (*G. gallinula*, L.).—*Caves*: Chudleigh.

DUNLIN (*Tringa alpina* ?, L.).—*Roman*: Caerwent.

KNOT (*T. canutus*, L.).—*Cave*: Chudleigh.

REDSHANK (*Totanus calidris*, L.).—*Caves*: Ireland: Kesh (Coffey), Edenvale (bottom level).

CURLEW (*Numenius arquatus*, L.).—*Roman*: Mount Caburn (Lewes).

WHIMBREL (*N. phœopus*, L.).—*Caves*: Clevedon, Chudleigh.

COMMON GULL (*Larus canus*, L.).—*Caves*: Clevedon. Ireland: Ballintoy.

HERRING-GULL (*L. argentatus*, J. F. Gmelin).—Scotland: Kit. midd., Ardrossan.

LESSER BLACK-BACKED GULL (*L. fuscus*, L.).—*Cave*: Ireland: Castlepook.

GREAT BLACK-BACKED GULL (*L. marinus*, L.).—*Roman*: (In D'Urban Museum, Exeter).

RAZORBILL (*Alca torda*, L.).—*Peat*: Burwell Fen. Ireland: Newhall Cave (top level). Scotland: Kit. midd., Caithness, Oransay, Ardrossan.

GUILLEMOT (*Uria troile*, L.).—*Upper Pliocene*: Yarn Hill. Ireland: Edenvale Cave (top level). Scotland: Kit. midd., Ardrossan, Colonsay, Oransay.

GREAT AUK (*Alca impennis*, L.).—*Caves*: Cleadon Hill, Whitburn (Durham). Ireland: Waterford. *Sandhills*: Whitepark Bay, Donegal. Scotland: Kit. midd., Oransay, Colonsay, Caithness.

LITTLE AUK (*Mergulus alle*, L.).—*Caves*: Chudleigh. Ireland: Kesh (Coffey, low level). *Neolithic*: in sands, Whitepark Bay.

ALBATROSS (*Diomedea anglica*, Lyddeker).—*Coralline crag*: Orford, Redcrag, Newbourn, Foxhall. (The red crag bones were compared with, and named *D. exulans* by the late Mr. Gerrard, of the British Museum, to whom I submitted them when the Canham Collection of crag fossils was being transferred to the Ipswich Museum.—A. B.)

WANDERING ALBATROSS (*D. exulans*, L.).—*Pleistocene brick-earth*: Ilford (Thames Valley).

PUFFIN (*Fratercula arctica*, L.).—Scotland: Kit. midd., Ardrossan.

GREAT NORTHERN DIVER (*Colymbus glacialis*, L.).—*Caves*: Ireland: Edenvale (top level).

RED-THROATED DIVER (*C. septentrionalis*, L.).—*Sub-Arctic*: Mundesley, Lea Valley. *Caves*: Ireland: Shandon, Newhall (top level).

GREAT CRESTED GREBE (*Podiceps cristatus*, L.).—*Caves*: Ireland: Kesh (Coffey), Edenvale, Bantick, Newhall (both levels).

LITTLE GREBE (*P. (Tachybaptes) fluviatilis*, Tunstall).—*Celtic*: Glastonbury. *Caves*: Ireland: Newhall, Edenvale (top level).

SHEARWATER (*Puffinus* sp.).—*Celtic*: Glastonbury.

APPENDIX.

Caves (England).

Brixham, Devon. Pengelly, 'Rept. Brit. Assoc. Adv. Sec.'

Carnforth, Lancashire. Jackson, 'Lancashire Naturalist,' 1909-10.

Chudleigh, Devon. Kennard (unpublished).

Clevedon, Somerset. Male, 'Bristol Nat. Soc.,' 1901.

Ightham, Kent. Abbott (locality, E. T. Newton, Fauna).

Kents Hole, Devon. Pengelly, 'Rept. Brit. Assoc. Adv. Sec.'

Kirkdale. Drake & Sheppard, 'Yorksh. Geol. Soc.,' 1909.

Langwith Bassett, Derbyshire. Mullins, 'Journ. Derbys. Arch. & Nat. Soc.,' 1913.

Longcliffe, Derbyshire. E. T. Newton & Bemrose, 'Journ. Geol. Soc.,' lxi. 1905.

Caves (Ireland).

Ballynamintra, Waterford. 'Trans. R. Dublin Soc.,' 1881.

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Castlepook (Doneraile). Ussher, 'Rept. B. Ass. Adv. Sec.,' 1908.

Fermanagh. Kinahan, 'Geol. of Ireland.'

Shandon. Adams, 'Trans. R. Irish Acad.,' xxvi. 1876.

Co. Sligo, Kesh (Plunkett, Coffey). Scharff, 'Trans. R. Irish Acad.,' xxxii. 1903.

Peats and River Alluvium.

Cambridge. Skertchly & Miller, 'Fenlands, Past and Present.'

Walthamstow, Essex. Woodward, 'Geol. Mag.,' vol. i.

Shell-mounds and Kitchen-midden refuse-heaps. Azilian and Neolithic.

Assynt. Peach, 'Rept. Brit. Ass. Adv. Sec.,' 1892.
 Ardrossan. J. Smith, 'Trans. Geol. Soc.,' Glasgow, 1891.
 Caithness. Laing & Huxley, 'Prehistoric Remains in Caithness,' 1886.
 Colonsay. Grieve, 'Journ. Linn. Soc.,' vol. xvi. 1889.
 Wright & Peach, 'Geol. Mag.,' 1911.
 Hastings. Abbott, 'Natural Science Review,' 1891.
 Oban. Peach, 'Mem. Geol. Survey Scotl.,' 1908.
 Oransay. Henderson Bishop, 'Proc. Soc. Ant. Scotl.,' xlvi.
 Whitepark Bay, Co. Antrim. Knowles.

Celtic Lake Dwellings and Roman Sites.

Celtic :—

Glastonbury. Andrews, 'Ibis,' 1894.
 Barton Mere.
 Ulrome.

Roman :—

Caerwent, Corbridge. 'Archæologia,' 1892 *et seq.*
 Silchester. *Id.* 1892–1909.
 Mount Caburn, Woodcuts, Cranborne Chase. Pitt Rivers, separate memoirs, privately published.
 Crannogs, Ireland and Scotland. Munro, 'Lake Dwellings.'

The 'Vertebrata of the Forest-bed' and 'Pliocene Vertebrata,' both by E. T. Newton, Esq., F.R.S., contains the few references to pre-glacial birds.

The 'Catalogue of Fossil Birds in the British Museum,' R. Lyddeker, may be also consulted with advantage.

NOTES ON THE FAUNA OF THE COUNTRY OF
THE CHESS AND GADE.

By T. E. LONES, M.A., LL.D., B.Sc.

(Continued from p. 168.)

ENTOMOSTRACA.

THESE notes on the Entomostraca relate to work done at two distinct periods, one from the year 1898 to 1902, and the other from the year 1911 to the present time. The original notes for the earlier period have been lost, but I remember some of them sufficiently well to justify making use of a few which happened to relate to the Entomostraca of a few localities of the Gade district, for by far the greatest parts of the notes referred to specimens taken from the country extending from Kensworth and Dunstable on the east to Wendover and Aylesbury on the west. It will be evident, therefore, that the notes for the earlier period will be few and fragmentary compared with those for the later period.

Records of Entomostraca for parts of the country of the Chess and Gade have been made by other workers. These records, so far as I have been able to obtain them, refer chiefly to Watford and Berkhamsted in West Herts. For localities in the Buckinghamshire part of the Chess district I have not succeeded in finding any records. The 'Journal of the Quekett Microscopical Club' does not appear to give any, and the account of the Entomostraca given in the 'Victoria History of the County of Buckingham' refers mainly to Burnham Beeches and Stoke Park.

Fifteen species were obtained from the Watford district by Mr. John Hopkinson about the year 1878, and are recorded on p. 187 of vol. i. of the 'Victoria History of the County of Hertford,' published in 1902. Again, in a paper entitled "The Crustacea of West Herts," printed in the 'Transactions of the

Hertfordshire Natural History Society,' vol. xv., Hertford, 1914, pp. 127-136, Mr. Edward Popple records the occurrence of a comparatively large number of species of Entomostraca. About forty of these are recorded for parts of the country about Berkhamsted, Hemel Hempsted, and Chipperfield. Some of the records above referred to will be mentioned when describing the

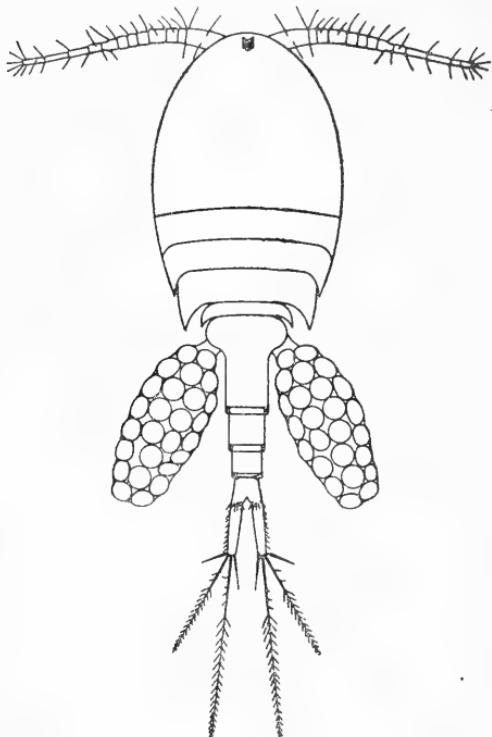


Fig. 21.

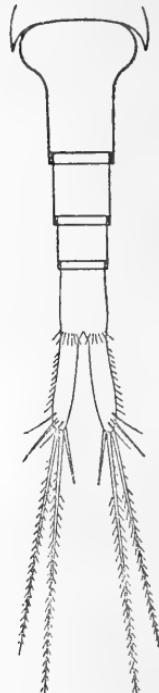


Fig. 22.

various species in the following notes, which, like those on the Rotifera, will commence with some of the common species.

1. *Cyclops serrulatus*, Fischer.—Of all the Copepoda of the country of the Chess and Gade this is the commonest. Not only have specimens been obtained from almost every pool and from many parts of the canal, the Chess, and the Gade, but they have been obtained at all seasons of the year. My rough notes contain so many accounts of collections of specimens of this species that it seems best to give the general conclusions which may be drawn from them, limiting the detailed references to those

collections which present features of special interest. A short description of the normal form of *C. serrulatus* will, however, be given first, special attention being paid to structural features which are liable to variation.

Graceful in form, the female has slender and tapering anterior antennæ, which, reaching as far as the third cephalothoracic segment, are only of moderate length; the eighth segment of each antenna is shouldered, and the tenth, eleventh,



Fig. 23.

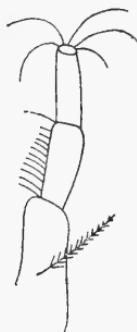


Fig. 24.

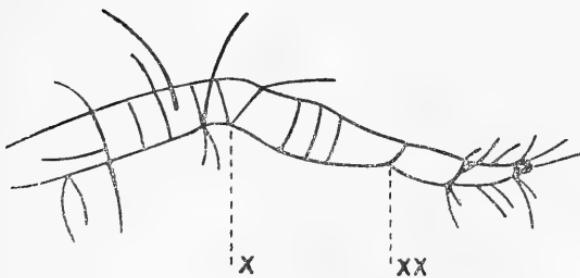


Fig. 25.

and twelfth (see fig. 21) are long and slender. A long and slender abdomen (figs. 21 and 22) terminates in two long and slender furcal segments, which are five times as long as they are wide. The most remarkable feature, however, is a row of short spines bordering the greater part of the outer edge of each furcal segment. These are shown in figs. 21 and 22, and will be called the "combs." Two short setæ, without cilia, arise from the lower part of each furcal segment, and from the end of each segment extend four ciliated cilia of which the fourth or outermost is short, the first or innermost somewhat longer, the third much

longer, and the second longer still and about as long as the abdomen. The cilia of the second and third setæ are strongly developed, but those of the first and fourth are not. The form of the fifth pair of feet is shown in fig. 23, and that of the posterior antennæ in fig. 24. The shape of the red eye and the arrangement of numerous setæ and cilia, not specifically referred to above, can be seen by reference to the various figures. There are two compact, oval, and divergent ovisacs, the angle between their long axes being 60° or more. The colour of the cephalothorax is usually brown or yellow, and that of the ovisacs is usually green. From the tip of the cephalothorax to the extremities of the longest tail setæ is about 1.25 mm. or less than $\frac{1}{20}$ -inch, and the cephalothorax is about 0.5 mm.

The male is smaller, more slender, and, neglecting its swollen anterior antennæ, more elegant in form than the female. Its movements are very rapid, and each traverse it makes appears to be slightly zig-zag. Each antenna is swollen and hinged so as to form an "elbow" X and a "wrist" XX, fig. 25, to adapt it for use as a clasper. The capability of movement of the "wrist" is very great, as may be seen by narcotizing the Copepod with eucaine when the terminal part of the antenna is seen repeatedly straightening out and then folding down close on to the rest of the antenna. Fig. 25 was drawn from a male obtained from Parsonage Farm Pool. Only a few of the writings on the Copepoda give a drawing of the antenna of the male *C. serrulatus*. The drawing best known to me is fig. 28, plate x. in vol. 24, second part of the 'Bull. de la Soc. Impériale des Naturalistes de Moscou,' 1851, accompanying Sebastian Fischer's account of Copepods from the neighbourhood of Petrograd.

The length of the antenna, when reflexed, is about equal to that of the first cephalothoracic segment. The total length of the male is 0.85 mm., and of the cephalothorax about 0.38 mm.

Proceeding to the consideration of the results obtained from the examination of the very large numbers of *C. serrulatus* from the country of the Chess and Gade, it will be convenient to take in order the following subjects of inquiry :—

1. The relative numbers of specimens at different times.
2. The possible conditions favouring the occurrence of large numbers of *C. serrulatus*.

3. The occurrence of ova-bearing females.
4. The occurrence of males.
5. The occurrence of specimens presenting varieties of form and size.
6. Variations of colour of specimens.

1. *Relative numbers of specimens at different times.*—During every month of the year numerous specimens (including immature specimens) have been obtained. The identification of the immature specimens is difficult and not always satisfactory; they seem, however, to be relatively most numerous in the month of November, and they have also been relatively numerous in the months of April and May. My records for the usually uninviting month of November are fewer than those for other months, but the most noteworthy is one for November 12th, 1913, when thousands of immature specimens of *Cyclops* were obtained from Langleybury Pool; in many of these the combs of *C. serrulatus* were just discernible; not a single specimen with ova was seen. In the same pool, on May 2nd, 1914, there were numerous specimens of *C. serrulatus*, all except a few being immature forms in the Nauplius stage or the Copepod stage, and only one ova-bearing female was seen. On April 28th, 1913, numerous specimens in the Nauplius stage were obtained from Wigginton Pool; in this case, however, there were also many ova-bearing females, and the birth of young ones was proceeding rapidly.

Taking account of adult specimens only, the largest numbers have been obtained in August, September, and October, and large numbers have been obtained in March, June, July, and January.

The above results are based on an examination of the records as a whole. When the yields of any particular locality are considered, it is found that they vary greatly from year to year. Chipperfield Common Pool furnished only a few fully developed specimens on August 2nd, 1912, but a very large number on August 4th, 1913. Nearly a hundred specimens were obtained on September 14th, 1912, and not one on September 15th, 1913; a few were obtained on April 8th, 1913, and none at all on April 11th, 1914. The dates compared in each year are nearly the same, but there were distinct differences in the yields of adult

specimens, and these differences are more striking when it is borne in mind that Chipperfield Common Pool presents more uniform conditions from year to year than most other pools in the district. It seems that in 1912 the time of appearance of large numbers of adult specimens of *C. serrulatus* in this pool was in September, but in the year 1913 it was in the beginning of August.

2. *The possible conditions favouring the occurrence of large numbers of C. serrulatus.*—With respect to the numbers of specimens obtained, different localities in the country of the Chess and Gade, as stated already, have given very different results. A large number, however, have often been taken at a single dredging from the pools of Chipperfield Common, Parsonage Farm, Langleybury, Frithesden, Boxmoor Common, Chorley Wood Common, Whelpley Hill, Cholesbury Common, Coxpond and Wigginton, from the Berkhamsted Castle Moats, and from the Chess at The Moor, Chesham, and the Gade at Great Gaddesden. There are other localities for which the yields have been very poor. Two of such localities, *viz.* Chesham Road Pool and Bedmond Pool, have yielded, on many occasions, only a few specimens or none at all. Other pools which may be mentioned are those at the brick-kilns, Tyler's Hill, east of Chesham, Hastoe Pool, and Aldbury Pool. From these three pools only a comparatively small number of collections have been made; the pools at Tyler's Hill, it may be said, are not attractive to collectors since, as far as my experience goes, their waters are covered by a film of soot. Of Chesham Road Pool and Bedmond Pool I can speak with greater confidence, for many water samples have been taken from them, and it seems strange that they have given such poor results.

Cyclops serrulatus certainly does not seem to be particular as regards its habitat. Height above sea-level, depth of the water, nature of the water, and its situation with respect to sun and wind no doubt influence the life of the Copepod to some extent, but in the country of the Chess and Gade they do not seem to have much effect. Wigginton Pool, 700 ft. above sea-level, has yielded numerous specimens, and so has Langleybury Pool, which is 500 ft. lower; many specimens have been taken from water pure enough for Perch and Trout, and from water foul

enough to suit the rotifer *Hydatina senta*; and the localities above-mentioned, where *C. serrulatus* thrives, vary much with respect to depth of water and exposure to sun and wind. They all agree in having a muddy bottom or masses of *Confervæ* or other small aquatic plants in which the Copepod can readily burrow and take refuge. *C. serrulatus* seems to be very prone to burrow into mud and masses of small aquatic plants when it is disturbed, and this habit I have repeatedly observed when examining the various water samples containing this Copepod; on some occasions, in fact, a few specimens have in this way escaped capture for some time. It seems that the presence of a muddy bottom, or of *Confervæ* or other small aquatic plants, or of floating leaves fallen from adjacent trees is especially favourable to the presence of large numbers of *C. serrulatus*.

Bedmond Pool, which has always given very poor results, rarely presents any of these features. As far as it can be examined from the sides, its bed, which sinks rapidly towards the centre where its depth is said to be over twelve feet, is almost everywhere clean and stony. The poor results obtained from Chesham Road Pool cannot be due to absence of mud, and, in some parts, there is no want of aquatic plants to serve as cover, so that I have been at a loss to understand why more specimens have not been obtained. Examination of the habits of another species of *Cyclops*, of which a moderately large number of specimens have been obtained from the pool, seems to suggest one cause. I refer to *Cyclops fuscus*, Jurine, a stoutly built and aggressive Copepod. Many times I have seen individuals of this species attack others, especially specimens of *C. serrulatus*, with great energy, and ova-bearing females in particular have been left lifeless, or nearly so, after these attacks. The numbers of *C. serrulatus* are no doubt also kept down (and so also those of *C. fuscus*) by the Sticklebacks which are also found in the pool. It may be mentioned that these fishes are also found in Bedmond Pool, which also gives poor yields of Copepods, and these pools of Chesham Road and Bedmond are two of the few pools, altogether unconnected with the streams or the canal, which contain Sticklebacks.

3. *The occurrence of ova-bearing females.*—These have been obtained in every month of the year except November. The

number of records of forms of life taken from the various localities during November of the years 1912 and 1913 is six, and not a single ova-bearing female is mentioned in these records. The number of collections made in November is quite small compared with those of other months, and probably a few ova-bearing females could be obtained, in the early part of the month, in some of the pools. However, it seems to be a fair conclusion that, for ova-bearing females, November is the poorest month of the year. December also has given poor results, except towards the end of the month, while January has always yielded a large percentage of ova-bearing females, *e.g.* on January 27th, 1914, there was a large number of *C. serrulatus* in the small pool at Whelpley Hill, and many of these carried ovisacs, and on January 8th, 1913, eight ova-bearing females were obtained from a small water sample from the pound near the Gade at The Noake, and seven from a small water sample taken from Frithesden Pool on the same date.

The results for February have not been better than those for January. The records for March and, in a less degree, for April show a larger percentage of ova-bearing females than the records for May, which has given comparatively poor yields, although special mention should be made of a collection from Coxpond, on May 24th, 1915, when many such females were obtained. For the month of March there are two records of the occurrence of very large numbers of ova-bearing females. One of these collections was furnished by the Chess at The Moor, Chesham, on May 11th, 1913; the specimens were taken in a square collecting dish, which was scraped along the boards protecting the sides of the river. These boards are covered by a rather thick layer of *Confervæ* and other small aquatic plants, which arrest a lot of fine mud and afford cover to the Copepods. The other collection was obtained from Langleybury Pool on March 26th, 1914. Among the April records reference is made to only one very large collection of ova-bearing females, *viz.* one from Wigginton Pool on April 28th, 1913.

The records for the months June–October show very different results from year to year. Some comments on the liability of many of the pools to be dried up, entirely or to a large extent, have already been made when dealing with the Rotifera. This

drying-up of the pools of course affects their faunas in a very marked degree, and especially during the months referred to above. It is evident that conclusions drawn from work done during a series of a few years only may have to be modified in the light of work done during another series of years. This should be borne in mind when considering the following conclusions based on work done during the years 1912-1915.

Ova-bearing females were particularly numerous in the months of August, September, and October; and although it is not easy to decide which of these months gave the best results, it seems that October yielded the greatest number. The proportion of ova-bearing females as compared with all other adult specimens of *serrulatus* was, however, decidedly greater for September than for either August or October. Some of the pools furnished large numbers of ova-bearing females in June and July, but on many occasions not one was taken during these two months.

The largest number for a single dredging and the largest proportion of ova-bearing females was taken from Chipperfield Common Pool on September 14th, 1912, when sixty-one ova-bearing females and fifteen without ova were taken in one water sample. From the same pool sixteen ova-bearing females and fifteen without ova were taken on October 5th, 1912. Only a small proportion of ova-bearing females was obtained from the Pool on August 2nd, 1912, and August 8th, 1913, and on September 15th, 1913, Chipperfield Common Pool yielded no adult specimens of *C. serrulatus*; on this last occasion the water was low, brown, and turbid, and contained very few weeds. Very many specimens were obtained from the pool, already referred to, on Boxmoor Common on October 16th, 1912, and of these ten carried ovisacs. From a pool near Shire Lane Farm, however, numerous specimens were obtained on October 15th, 1913, and many of these had ova. Other collections which gave a fairly large number of ova-bearing females, and deserve special mention, were from the Gade, at Great Gaddesden, on June 3rd, 1913; Langleybury Pool, on June 18th, 1913; Chorley Wood Common Pool, July 21st, 1913; Langleybury Pool, July 13th, 1915; and Parsonage Farm Pool, August 11th, 1912. Following this last-named collection from Parsonage Farm Pool,

another was made on August 25th, 1912, and only one ova-bearing female was obtained. Many other examples might be given, all tending to show that the Copepod fauna of one and the same pool varies considerably within even short periods.

4. *The occurrence of males.*—I find that my rough notes are not sufficiently detailed to enable me to make any reliable generalized statement as to the months when male specimens of *C. serrulatus* are most numerous. Usually in water samples containing large numbers of this Copepod some males have been found; the largest number, however, of which I have any record or remembrance was taken from a small brook near the first lock on the way from Hunton Bridge to King's Langley on May 13th, 1913. There were plenty of ova-bearing females, but the males greatly surpassed them in numbers. To show the variability of collecting-results, the three following records may be given: (1) Four males and twelve ova-bearing females from Parsonage Farm Pool, on July 1st, 1915; (2) Many ova-bearing females and no males from Langleybury Pool, on July 13th, 1915; and (3) Two ova-bearing females and one male from Parsonage Farm Pool, on July 27th, 1915.

5. *The occurrence of specimens of C. serrulatus differing in form and size from the type.*—It has been due chiefly to a desire to consider this interesting subject in detail that I have collected so large a number of specimens of this Copepod. Numerous water samples have been examined without finding any specimens of *C. serrulatus* differing appreciably from the type. A few of the samples, however, have furnished specimens presenting interesting variations of form and size.

In the Ray Society's Monograph ('The Free-swimming and Semi-parasitic Copepoda of the British Islands,' G. S. Brady, vol. i. 1878, p. 111), a mountain form is referred to differing from the typical *serrulatus* chiefly in its darker colour, and in the less profuse ciliation of the various setæ. On plate 22 of the same volume is a drawing of a female of this mountain form, and such drawing shows neither combs nor cilia. It may be stated at once that I have not found a specimen of this form in the country of the Chess and Gade, but several which tended towards it. These specimens will be dealt with first. On April 8th, 1913, a few females with brown cephalothorax and green

ova were obtained from Chipperfield Common Pool. In most of them the combs were indistinct, and the cilia on the tail setæ were but slightly developed. From the entire water sample only one female with well-marked combs and cilia was obtained. Among a large number of ova-bearing females taken from Wigginton Pool on April 28th, 1913, there were some with combs imperfectly developed. On September 16th, 1913, some specimens from the Cashio beds, Watford, had combs weakly developed; in these specimens the body and ova were nearly white. Imperfectly developed combs were seen in some ova-bearing females obtained from Cholesbury Common Pool on May 26th, 1914, and in some obtained from Coxpond on May 24th, 1915; it should be noted that those from Coxpond were rather unhealthy specimens.

The next to be considered are those adult specimens having the combs, tail segments, setæ, and cilia unusually strongly developed. The combs were very strongly developed in many of the specimens obtained from Boxmoor Common Pool on October 16th, 1912; these specimens had brown bodies usually of a dark shade. On December 30th, 1912, many ova-bearing females were obtained from Chipperfield Common Pool. Their combs were exceedingly strongly developed, and the tail setæ were decidedly longer than usual; the tail segments of these specimens were also longer and more slender than those of any other specimen of which I have any record. In these specimens the cephalothorax was brown, usually of a dark shade. Some specimens, with a light-coloured cephalothorax, obtained from Potten End Pool, on January 8th, 1913, had very strongly developed combs. The tail segments were unusually long in some specimens taken from Wigginton Pool on April 28th, 1913, and the combs were also well-developed. From the same water sample, specimens with imperfectly developed combs were also obtained, as stated already. On September 30th, 1913, Berkhamsted Castle Moat yielded a few specimens with clearly visible combs; one of these specimens had the combs very strongly developed, and the second and third tail setæ were exceptionally long and well ciliated.

When examining the tail segments of specimens of *C. serrulatus* taken from Wigginton Pool on October 15th, 1913, I noticed what seemed to be endo-parasites wandering to and

fro in the segments. They were very small forms of life, oval, about twice as long as they were wide, unicellular, and nearly colourless.

It has been stated already that the angle between the long axes of the ovisacs is about 60° , *i. e.* when the female is swimming in plenty of water, otherwise of course the angle may be much less or greater. On September 14th, 1912, a specimen was obtained from Chipperfield Common Pool with the ovisacs nearly parallel instead of being inclined at the usual angle. There was no doubt about its being *C. serrulatus*; its combs were clearly seen, and its antennæ, &c., were those of *serrulatus*.

Most of the female specimens, fully developed and carrying ovisacs, from the country of the Chess and Gade have been about 1.25 mm. long from the tip of the cephalothorax to the extremities of the longest tail setæ. Occasionally specimens decidedly smaller than these have been obtained. On October 5th, 1912, many small ova-bearing females were obtained, together with some of normal size, from Chipperfield Common Pool; and on January 27th, 1914, many small females were obtained from Whelpley Hill Pool, but small as they were their combs and ovisacs were well-developed. From the Chess at The Moor, Chesham, abnormally small ova-bearing females were obtained on March 11th, 1913, and April 28th, 1913. The average size of these was about 1 mm. There is another peculiarity, to be referred to later, about the *serrulatus* of the Chess at The Moor, *viz.* the very light colour of the cephalothorax and the ova.

6. *Variations of colour of specimens.*—Probably no freshwater Copepod presents more variety in the colours of its cephalothorax and ovisacs than *C. serrulatus*, and in many cases the contrast between the colours of these parts is a very pleasing one. When speaking of the colour of the ovisacs, it should be understood that reference is intended to the ovisac with its full charge of ova, to which the colour is due, for the ovisac itself is colourless and nearly transparent. Not less than one half of the numerous ova-bearing females obtained from the country of the Chess and Gade had a brown or yellow cephalothorax and green ovisacs; as regards the shades, that of the

cephalothorax ranged from straw-yellow in some individuals to sepia in others, and the ovisacs from apple to olive green, grass green being the commonest shade. Specimens with a brown cephalothorax and brown ovisacs have been somewhat common, and chalky waters, like those of the Chess at The Moor and the northern section of the Canal, have yielded large numbers of specimens of *C. serrulatus* with the cephalothorax white or a very pale brown, yellow, or green scarcely distinguishable from white, and with ovisacs white or very pale. Occasional specimens of this last type of coloration have been taken from other localities. Among them were two with milk-white cephalothorax and ovisacs taken on September 12th, 1912, from the brook, already referred to, between Hunton Bridge and King's Langley, some taken from the Cashio beds on September 16th, 1913, with cephalothorax and ovisacs nearly white, and one with pale brown cephalothorax and white ovisacs taken from a pool near Shire Lane Farm on October 15th, 1913.

The above-mentioned three kinds of coloration, *viz.* brown or yellow cephalothorax contrasting with green ovisacs, brown cephalothorax and brown ovisacs, and white or very pale cephalothorax and ovisacs constitute altogether not less than four-fifths of the total number of specimens examined.

The remaining fifth included some specimens presenting a pleasing contrast of colours. On July 9th, 1912, a very restless *serrulatus* with yellow cephalothorax and cream-coloured ovisacs was taken from Chipperfield Common Pool. From Parsonage Farm Pool one with green cephalothorax and milk-white ovisacs was obtained on September 6th, 1912, and one with straw-yellow cephalothorax and milk-white ovisacs was obtained on September 22nd, 1912. One specimen with olive-brown cephalothorax and milk-white ovisacs was taken from Chipperfield Common Pool on September 14th, 1912.

Finally, some specimens with blue ovisacs of various shades have been obtained. One of these with pale blue cephalothorax and ovisacs was taken from the brook above-mentioned. Another specimen with bright yellow cephalothorax and blue ovisacs was taken from Fritheenden Pool on January 8th, 1913, and a third obtained from Langleybury Pool on February 20th, 1913, had bright blue ovisacs.

(To be continued.)

THE RELATION OF THE OYSTERCATCHER TO ITS NATURAL ENVIRONMENT.

By J. M. DEWAR, M.D.

(Continued from p. 383.)

IN North Perthshire the average monthly rainfall shows a progressive increase in amount through April, May, and June, the first being the driest month of the year. In April and May the rainfall tends to be evenly distributed over each month, and the water is largely absorbed by the soil. In June the greater rainfall is apt to be concentrated into torrential downpours, and most of the water runs directly off the land into the streams. The loch faithfully registers the increase and the changed character of the rainfall. In April and May the level is falling. Towards the end of May the loch is at bottom level. With the entry of June it begins to rise more or less quickly, according as the rainfall is above or below the average, and is, or is not, torrential in character. The fall and subsequent rise of the loch were well marked in May and June, 1912, the first half of June being excessively wet. At the time of the first laying in the beginning of May, 1912, the level of the loch was 0.6 metre below the winter high-water mark. The level fell another 0.3 metre in the course of May. From June 10th to 17th the water rose 0.7 metre. From this date the level of the loch fell irregularly. Data were obtained for four pairs in as many territories. In one instance the first laying was unknown. In the other three instances both the first and second layings were under observation. The first layings took place in the beginning of May, and all came to grief from various causes. The second layings occurred in the end of May and beginning of June. The relation of the seven nests to the level of the water, and the subsequent histories of the second layings, proved highly interesting. The results are given in the form of a table which is subjoined. The measurements are distances, no means being available to measure the heights of the nests above water-level. The fall of the loch was determined on two posts by the water-

marks visible in the end of May. The subsequent rise was anticipated by marking the posts from the observed lowest water-level.

Table 2, Showing Positions of First and Second Nests of each Pair Relative to Water-Level: Loch Tummel, 1912.

Nest A ¹ (unknown)	A ² Below winter H.W.M. 0·9 m. Above water-level, time of laying 6·4 m.
Nest B ¹ Above winter H.W.M. 1·2 m. Above water-level, time of laying 6·7 m.	B ² Below winter H.W.M. 2·1 m. Above water-level, time of laying 6·1 m.
Nest C ¹ Above winter H.W.M. ? Above water-level, time of laying 6·4 m.	C ² Above winter H.W.M. ? Above water-level, time of laying 6·4 m.
Nest D ¹ On winter H.W.M. Above water-level, time of laying 6·85 m.	D ² On winter H.W.M. Above water-level, time of laying 10 m.

Remarks.—At A² the winter high water-mark passed along the grass bank slightly above the shingle. On June 15th, 1912, the bird was flushed from the nest, which contained a pool of water. The margin of the loch was not far from the rim of the nest, the height of which was subsequently fixed at 0·74 m. above water-level at the time of laying. This bird converted the nest hollow into a platform 0·03 m. higher than its surroundings, and continued to incubate. The danger was past after the 17th, and the bird continued to sit. At B¹ and B² the position of the winter high water-mark was fixed with difficulty, there being no drift. The second nest was 3·35 m. further down the shore than the first, but the two nests were both situated at similar distances from the water-levels at the respective times of laying. The height of B² was later fixed at 0·66 m.; that of B¹ was +0·9 m. above bottom level. On June 17th, 1912, B² was drowned out and deserted, being 0·05 m. under water. At C¹ and C² the position of the winter high water-mark could not be determined, but judging from collateral evidence both nests were considered to be much above that level. Both nests were equidistant from the water-levels at the time of laying. C² escaped the highest flood-level of June 17th with a good margin, the calculated height above bottom level

being 0·96 m. At D¹ and D² the winter high water-line was marked by a large quantity of small flood rubbish. Both nests were laid on this line, D¹ slightly above, D² slightly below, its centre. D² was in no danger, being 0·9 m. above bottom level.

It is evident from the history of these nests that, in any further observations on the choice of nesting site, distance from the water will have to be considered along with height above water. The D¹, D² nests lead one to expect that flood rubbish, when it is present, controls the tendency to follow the descent of the level of the water. The main point, however, which it is desired to bring out has already been stated, and may here be repeated, that the stereotyped behaviour appropriate to the normal laying period, when the rainfall is small and fairly uniform and the level of the loch is sinking, is not so successful in controlling the situation in the different environmental conditions of a later abnormal laying period when the rainfall has increased and the level of the loch is rising.

VII.—THE LAW OF TERRITORY.

Each settlement on the south shore of the Forth has an habitual range which it rarely exceeds. Individual settlements have not been known to trespass on each other's feeding-grounds for the purpose of feeding. It is remarkable that from winter to winter the position and total areas of the several territories show no change, and that the occupants of each territory have a similar routine of activities year after year. It has not been found possible to point to any general or specific variation of behaviour, relative to the environment, by comparing the observations of one year with those of another (1906–1914). All the settlements under observation in the Firth of Forth have, in each case, a refuge which is also the headquarters of the station. In places where the refuge is not resorted to at every high water (neap tides, nocturnal high water) and in localities where no refuge is available or necessary, a certain part of the beach, on the high water-mark, is constantly used in preference to other parts as a resting place during high water, and therefore may be regarded as the headquarters. In the Forth the territories are well-defined owing to the intervention of broad bands of neutral shore having little food value. The more

intimate nature of the probable inter-relations of the settlements of a district has been observed in the Aberlady district. The Aberlady, Eyebroughty and Lamb stocks have never been known to visit each other's feeding-grounds for food. The Aberlady and Eyebroughty stocks share Eyebroughty, as a refuge. On one occasion a shooting party was landed on Eyebroughty towards the time of high water, the boat which brought them being sailed about in the vicinity. The Eyebroughty settlement anticipated the boat's arrival by proceeding towards the Lamb, on which they were observed through field-glasses to alight, and where they evidently remained. The Aberlady Bay waders arrived shortly after at Eyebroughty, and were unable to land. They did not proceed to the Lamb, but flew round and round high over Eyebroughty for nearly two hours, until the ebb of the tide allowed them to return and alight safely in Aberlady Bay. After Christmas, when the first signs of nuptial activities begin to appear, visits are exchanged between the Aberlady and Eyebroughty settlements, and between the latter and the Lamb settlement; but, so far as known, never between Aberlady and the Lamb.

As a possible indication of the need of controlling the food-supply for the welfare of the settlement, by maintaining territorial rights, there may be cited the results of a periodical examination of the sizes of shells opened by the Oystercatchers at the Eyebroughty station in the course of winters 1908-1909, 1911, and 1912. The results suggest that, in this area at least, the food-supply is subjected to a considerable strain in meeting the needs of the settlement.

In the Eyebroughty area the average and largest sizes of the mussels showed a continuous fall in the course of the winter 1908-9.

Table 3, Showing Seasonal Diminution in Size of Opened Shells of *Mytilus* from "Mussel-Rocks," Eyebroughty: Winter 1908-9.

DATE.	NUMBER.	AVERAGE.	LARGEST SHELL.
Oct. 29th, 1908	10	$3\cdot1 \times 1\cdot4$ cm.	3·7 cm. long
Nov. 16th, 1908	23	$2\cdot25 \times 1\cdot0$ cm.	2·8 cm. long
Jan. 4th, 1909	....	...	2·5 cm. long
Jan. 26th, 1909	....	...	1·9 cm. long

A considerable proportion of the food-supply at Eyebroughty is derived from the oil-shales in the bay west of Weak Law. The collections made here in the course of the winters 1911 and 1912 show a steady seasonal fall in the sizes of *Tapes* and *Modiolus*, and confirm the results for *Mytilus* in the same area.

Table 4, Showing the Seasonal Diminution in Sizes of Opened Shells of *Modiolus* and *Tapes* from "Shales," Eyebroughty: Winter 1911-1912.

MODIOLUS.			TAPES.		
Date.	No.	Average.	No.	Average.	
Nov. 30th, 1911	8	5·0×2·5 cm.	6	3·0×2·3 cm.	
Dec. 11th, 1911	...	...	6	2·6×2·2 cm.
Dec. 26th, 1911	8	2·8×1·55 cm.	...	...
Dec. 27th, 1911	...	...	32	2·4×1·5 cm.
Nov. 18th, 1912	13	4·9×2·4 cm.	...	...
Nov. 28th, 1912	...	...	20	2·6×2·0 cm.
Dec. 12th, 1912	...	...	15	2·3×1·7 cm.
Dec. 17th, 1912	38	2·3×1·3 cm.	...	...

The Limpets are more abundant on the shales than are *Tapes* and *Modiolus*. Though they are largely fed upon, the Limpets show great recuperative powers. Grouped in the two fortnightly periods for November, 1912, the results do not show an appreciable change. When, however, separate returns are taken from a fortnightly feeding period, a gradual fall appears in the averages.

Table 5, Showing Seasonal Average Sizes of Limpets fed upon by Oystercatcher: "Shales," Eyebroughty, November, 1912.

DATE.	NUMBER.	AVERAGE.
November 15th, 1912	53	2·2×1·5 cm.
November 28th, 1912	66	2·0×1·5 cm.
November 12th, 1912	8	2·7×2·0 cm.
November 14th, 1912	24	2·3×1·4 cm.
November 18th, 1912	19	1·9×1·5 cm.

In the summer habitats each pair has an habitual range in a nesting area and in a local feeding-ground. The boundaries, where the range of one pair meets those of adjacent pairs, are elastic; depending, in part, on the presence or absence, at the

moment, of the adjoining pairs. Each station, composed of the breeding area and the local feeding-ground, has a headquarters generally, but not always, situated on a small eminence between the two areas. At the headquarters the birds keep watch and issue challenges. All other birds of the species are driven from the breeding area and the local feeding-ground. The territorial arrangements show no change from year to year (1909-1914). The young at first do not have an habitual range. Where two territories adjoin, the young of one territory are apt to wander into the other until they are called back by their parents or driven away by the other pair. The general or distant (neutral) feeding-ground is apparently common property. All the birds of a district appear to be free of the arable land near the breeding territories, and mingle without signs of hostility. It is, however, probable that closer observation would show that each bird has an habitual range in the general feeding-ground, though there is no apparent tendency to exclude other birds from its range.

Thus the main requirement of the Law of Territory, enunciated by H. Eliot Howard, is fulfilled in the summer environment of the Oystercatcher. The law should be extended to apply to the birds in winter, as they then have territories, though no opportunity has come under notice of a territory needing to be defended against intruders. The mode of acquiring the winter territory is unknown. In summer, the method differs from that observed by Howard in British Warblers, as Seton Gordon records that the birds ascend the rivers in pairs. My own observations indicate pairing to take place on the sea-coast. The subsequent course of events nearer the breeding territories is not known. Howard's view that the possession of territories is a biological advantage both to the individual and the species, by securing an adequate, and no more than an adequate, supply of food, is borne out by the general evidence derived from the areas under observation, and by the results obtained at Eyebroughty.*

(To be concluded.)

* H. Eliot Howard, 'The British Warblers,' part iii., 1909; Part v., 1910; Part ix., 1914. Seton Gordon, 'Birds of the Loch and Mountain,' p. 97.

NOTES AND QUERIES.

MAMMALIA.

Leisler's Bat in Somerset.—On October 13th a Bat was brought to me by my gardener, who caught it flying about in the kitchen of his cottage, which a reference to Barrett-Hamilton's and Hinton's excellent work on 'British Mammals' showed to be an example of Leisler's Bat (*Nyctalus leisleri*). In view of the comparative rarity of this Bat in this country, I sent it up to Mr. Martin Hinton at the British Museum, who has very kindly confirmed the identification. As the Bat does not appear to have been recorded before from the Mendip district of Somerset, I think its occurrence worth noting.—
J. WIGLESWORTH (Winscombe, Somerset).

AVES.

Mandarin Ducks at Woburn; Pheasants Feeding in Trees.—I have not noticed Mandarin Ducks eating acorns, but of course they sit a great deal in trees and breed in them. They are thoroughly established at Woburn, and seem to stray very little. They did not do at all well until we left them unpinioned. They have large broods, and a large proportion of them seem to survive the perils that most young ducks succumb to. We now reckon them one of our most successful importations amongst birds. During the last few days I have on three occasions seen Pheasants sitting in apple-trees eating apples. I do not know whether this habit has been often observed.—
M. BEDFORD (Woburn Abbey).

Late Nesting of Cirl-Bunting in Somerset.—On August 13th I found a Cirl-Bunting's nest with five hard-set eggs. The usual breeding-time here is the end of May or early June. The nest of this species seems to contain five eggs more frequently than that of the Yellowhammer, which seldom lays more than four in this district.—
JOSEPH H. SYMES (Coat, Mastock, Somerset).

Localized Occurrence of Black-backed Gulls.—Referring to Mr. Patterson's interesting notes (p. 372) it seems curious that the Lesser Black-backed Gull should be so uncommon at Yarmouth, while at

Lowestoft a few weeks before now (October 17th) it was to be seen every day. Lowestoft Pier is now in the hands of the naval authorities, and sometimes on a rough day I used to get into a sentry-box at the east end to watch the Gulls. Some fine old Lesser Black-backs would come quite close, especially when there had been a turn-out of refuse, which attracted a swarm of voracious sea-rovers. I could not identify the Kittiwake or the Great Black-back, but there was no doubt about the other four British-breeding Gulls. Having committed myself to a lantern-talk on "Our Summer Migrants" during the coming winter, I asked a friend who is well up in East Coast migration whether the Lesser Black-back might fairly be included, as I possess a very good picture of a group taken on the Farne Islands. His opinion was that it certainly might, as it was never to be seen in mid-winter, when the Great Black-backed and Herring Gulls are more abundant than at any other time.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds).

Gannet Nesting in Orkney.—I am informed by a correspondent that a pair of Gannets nested in 1914 on the Horse of Copinsay, off the east coast of Orkney. There was no news of the birds this year; but as a lighthouse is now being built, it is not likely that the birds have bred there this season.—O. V. APLIN (Bloxham).

Some Notes on the Nesting of a Pair of Moorhens:—

April 12th.—Moorhens commenced constructing a nest on some overhanging bushes, placed for that purpose at the side of a pond in my orchard. The nest is about eighteen inches above present water-line.

20th.—This nest appears never to have been further completed, except perhaps a very few additional pieces of rush have been added.

May 5th.—A second nest has been built on some dead bushes alongside brook, thirty yards distant from the other nest at the pond, and now contains three eggs.

7th.—7.30 p.m., a storm in the evening washed away the nest and eggs. Another nest, formed on the top of a stub amongst an accumulation of sticks and other refuse, found the same afternoon, a distance of two hundred and twenty-five yards above stream. I never saw a bird at this nest afterwards.

9th.—8.30 a.m., an egg in the first nest at pond.

11th.—6.30 a.m., still the one egg only, but the position of it has been altered. 6.30 p.m., egg removed.

17th.—An additional nest on the bushes over pond, some seven feet away from other nest.

18th.—6.30 p.m., two eggs in the new nest.

19th.—1 p.m., two eggs. 7.30 p.m., three eggs.

20th.—7 a.m., three eggs. 5.30 p.m., four eggs.

21st.—5.30 p.m., four eggs, and hen bird flushed from the nest. 5.34 p.m., she returned to her nest. 6.30 p.m., five eggs. It is evident this bird lays her eggs between 5 and 6 o'clock in the evening. From investigations made subsequently with other Moorhens, it seems probable that their eggs are usually laid about this time of day.

22nd.—Sixth egg laid, and the last one of the clutch.

June 10th.—6 p.m. to 8 p.m., I could hear at some little distance from the nest the cheeping of a young one within one of the eggs.

11th.—7 a.m., one young Moorhen hatched. 3.30 p.m., two young ones hatched, one of which descended on to the water eighteen inches below the nest.

12th.—Four young hatched; two addled eggs left in nest. Incubation therefore appears to be about twenty days in duration.

14th.—All the young take freely to the water.

17th.—The first nest, constructed on April 12th, has now been made up with some fresh green rushes, and it is now used as a roosting-place by the hen bird and her young. The cock bird sleeps close at hand at the pond also.

24th.—The adult birds during the daytime take an equal share in their attention to the young. Either of the parent birds may be observed accompanied by one or more of the young busily searching the pond, brook, or adjoining grassland for their food.

25th.—I came rather suddenly upon the Moorhens with their chicks feeding in the orchard among the newly-mown grass; the young immediately sought cover under the swaths, the old birds walked sedately down to the pond without giving the least indication or betraying any anxiety that their young were present. The two addled eggs are missing from the nest in which the young were reared.

26th.—I killed with a rifle a Rabbit that was feeding within a few yards of one of the Moorhens and its young. The Moorhen was from its actions evidently very surprised at the collapse of the Rabbit without apparent cause. It went up to the dead Rabbit and walked around within about eighteen inches of it, and spent some considerable time trying to satisfy its curiosity. The young Moorhens are now showing a very independent spirit, and can often be seen foraging about the grassland unaccompanied by either parent.

When alarmed they run to the pond, and have become very expert at diving. They can already progress some yards under water.

29th.—4.15 a.m., one of the parent birds very busy stealing hay for its nest from a hay-cock near by. This continued for fifteen minutes, and each visit was made practically every twenty-five seconds. After completing what was necessary to the nest, a Rabbit feeding some short distance away was driven from the vicinity of the pond; perhaps the possible repetition of the former mystery was not welcomed.

July 8th.—The young are now frequently seen at considerable distances from the pond.

13th.—The hen bird and young always retire to the roosting-nest much earlier than the male bird returns to sleep at the pond.

16th.—Raining steadily. The young retire to sleeping-nest at 6 p.m., but leave it again for a short time at 7 p.m.; as a rule they settle down for the night fully an hour later.

19th.—Heavy rains the last few days. The nest further added to with more grass and rushes.

20th.—5.30 p.m., watched further building up of the nest. I have never seen both birds at work together, and I think it is only the hen bird that constructs the nest.

22nd.—4.30 a.m., the old bird again adding to nest. 4.45 a.m., the first young one left the nest, followed by another at 5 a.m.

23rd.—4.30 a.m., hen bird first left her brood; the latter remained in nest for some time after.

27th.—Further nest construction.

August 3rd.—Two of the four young appear to be missing.

4th.—Heavy rain. Roosting-nest now completely under water. The nest in which the young were hatched has been considerably added to, and is now being used for roosting purposes. The other nest was never reoccupied, although the water was at its normal height again a few days afterwards.

16th.—From August 3rd a Stoat has made almost daily visits to the pond (see 'Zoologist,' September, p. 354). At such times the old birds call the young quickly to the water, and keep them well in the centre out of harm's way, calling with loud alarm notes in the meantime.

20th.—Old bird ceased to roost with the young about this date. The care of the young has lasted about ten weeks.

28th.—A fifth nest has been constructed near by where the flood washed away their first nest and eggs, but I cannot see that it is put to any purpose.

September 4th.—One young one only now roosts in nest.

8th.—A sixth nest constructed along brook side near where the nest was formed in top of alder stub. This nest also I cannot ever find occupied.

25th.—Both young first seen to take to the wing. It is now fifteen weeks since they were hatched.

30th.—The two young seen roosting on the brood nest for the last time. The old birds have only visited the pond during the day for some time past.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

Ring-necked Parrakeets (Palæornis torquatus) at large in London.—Two of these birds haunt the neighbourhood of Clissold Park, N. ; whether they are a pair or not I cannot say, but regularly every morning, at 8.15 or thereabouts, one can see them; they attract one's attention by their screaming. At first I could not locate them, owing to their quick flight, but can now detect them immediately ; they always seem to fly in the same direction, due north, at the above time. I have never seen them at any other time than in the morning ; whether they go away and return later I cannot say.*—C. T. NEWMARCH.

Grey-breasted Variation in Robin.—On September 19th, and again on the 22nd, and on two occasions since, I observed in the Zoo, among the bushes at the back of the Diving-birds' House, a Robin which had the red confined to the face and throat, the rest of the area which is commonly red being slate-grey. The rest of the plumage was normal, and the bird was adult.—F. FINN.

Yellow Bill in Female and Young Blackbirds.—For some years past I have noticed the common occurrence of a yellow bill in hen Blackbirds in our London Parks ; it is now, I think, the rule for the hen to have a yellow bill, though not quite so bright as the cock's, and I have noted this during the present year in localities as far apart as Regent's Park and Kew. About mid-summer I saw at the back of the Zoo library a newly-fledged young bird with a yellow beak, so this local variation looks like extending further.—F. FINN.

* A male Parrakeet of this species was seen by us on more than one occasion in a recent summer at the south end of Regent's Park, apparently quite at home ; there has been also a bird of this genus in Hyde Park for a year or two, which we have seen at a distance, but we are not sure if it is the common Ring-neck, or one of the races of the large and distinct "Alexandrine" Parrakeet (*P. eupatrius* group).—ED.

ASTEROIDEA.

Common Starfish Attacking *Syngnathus acus*.—It has already been recorded in 'The Zoologist' for April and June, 1915, that the Common Starfish (*Asterias rubens*) has eaten dead or dying *Æquoreal* and Broad-nosed Pipe-Fishes of ten and twelve inches in length. A Starfish has since been seen to seize a strong and vigorous Great Pipe-Fish (*Syngnathus acus*) of eighteen inches in length. The Pipe-Fish, which threw its body into vigorous contortions when it was taken in the hand, was dropped into an aquarium containing two Starfishes, as it was not deemed possible that the latter could or would attack so large and strong an animal. The Pipe-Fish, as it fell through the water, passed a Starfish, which was clinging to the vertical rockwork of the aquarium. When the fish reached the bottom it lay still, perhaps a little fatigued with its four hours journey in a collecting-can from the coast. The Starfish, which was about six inches away, almost immediately began to descend quickly and directly towards the fish, with the slender terminal tube-feet of its foremost rays waving in the water in the manner characteristic of these tube-feet when the Starfish is advancing towards food. When the Starfish reached the Pipe-Fish it moved upon the latter in such a way that it embraced the whole head and fore-part of the fish with two rays. The Pipe-Fish did not move until the Starfish had affixed a number of tube-feet of each ray to its body. The Pipe-Fish then gave several violent jerks, but to the astonishment of myself and another observer it was unable to get free. The two animals were lifted out of the water and separated, the Pipe-Fish being placed in another aquarium.—H. N. MILLIGAN.

Rate of Locomotion in a Sun-Star.—It seemed desirable to ascertain the average rate of locomotion in a small Sun-Star (*Solaster papposus*), measuring two inches from tip to tip of opposite rays, which has been living in an aquarium for twenty weeks. This was somewhat difficult owing to the fact that the animal did not usually maintain a straight course, but on twenty-three occasions it was found possible to make measurements. It was observed that when it was moving along the side (of slate) or front (glass) of the aquarium with one ray just touching the surface of the water, it would often advance in a straight line, and the majority of the following measurements were made on such occasions. This Sun-Star has a habit of very suddenly reversing the direction of locomotion, and this has made it possible to determine the times and measurements with accuracy. The records were as follows:—12 inches

in 320 seconds, 8 in 180, 8 in 240, $6\frac{1}{2}$ in 180, $14\frac{1}{4}$ in 360, $3\frac{1}{2}$ in 90, $4\frac{1}{2}$ in 120, $9\frac{1}{2}$ in 210, 6 in 150, $8\frac{1}{2}$ in 180, $6\frac{1}{4}$ in 150, $5\frac{1}{2}$ in 150, 5 in 180, 4 in 95, 13 in 360, 18 in 400, 12 in 380, $3\frac{1}{2}$ in 135, $13\frac{3}{4}$ in 375, 11 in 300, 12 in 255, 5 in 100, and 6 in 135. It can readily be calculated from these figures that the average rate of locomotion was 1 in. in 26.1 seconds, the fastest rate recorded being 1 in. in 21.1 seconds, and the slowest 1 in. in 38.5 seconds.—H. N. MILLIGAN.

C R U S T A C E A.

Spider-Crabs Fastening Beef to their Bodies.—On three occasions within six weeks it has been observed that the Long-legged Spider-Crab (*Stenorhynchus phalangium*) has fastened during the night pieces of beef, given to it for food, in the hook-like setæ upon which it usually affixes the disguising materials. One individual affixed a piece of about a quarter of an inch in diameter to its rostrum on the night of July 20th–21st, 1915. Another affixed a piece of about the same size to one of its legs on August 19th–20th, and a piece to its rostrum on August 27th–28th. All three pieces disappeared within two or three days, having apparently been eaten by the Spider-Crabs. Pieces of animal matter could hardly be of use as a disguise, and indeed would probably be exceedingly dangerous, inasmuch as they might attract enemies. Several weeks residence in an aquarium, in which the Spider-Crabs were immune from attacks of other animals, may have had something to do with their curious behaviour, but it must not be forgotten that Spider-Crabs will sometimes use their disguising materials (seaweeds, zoophytes, &c.) as portable larders upon which they can draw when they are without the reach of food.

H. N. MILLIGAN.

NOTICES OF NEW BOOKS.

The Alligator and its Allies. By ALBERT A. M. REESE, Ph.D. New York and London: G. P. Putnam's Sons. 1915. 10s. 6d. net.

THIS exhaustive and fully-illustrated work is one of a type which ought to be far more common—the intensive working-out of the characteristic of a single species, with due reference to its various allies; Mivart's fine work on the Cat being a well-known example. Dr. Reese gives us a brief review of the Crocodilia as a whole, and a special account of the life-history

and habits of the American Alligator (*Alligator mississippiensis*) ; then follow several chapters devoted to the anatomy, skeletal, muscular, nervous, visceral, &c., and finally an account of the embryology of the Alligator and a bibliography. The frontispiece is a colour-photograph of the Alligator.

We are rather surprised to find that the chapter on the muscular system is, as stated in the preface, a translation from Bronn's 'Thierreich, and that the descriptions therein have not been verified by Dr. Reese, especially as he says in this chapter that Bronn in turn has followed Gadow, and that the reptile described in this German work is a Crocodile (of a species not particularized) and not either of the two known Alligators, the American, or the Chinese *A. sinensis*. It would surely have been better to defer the publication of the work until the muscles of American Alligators could be worked out ; the author's position as professor of zoology in the West Virginia University should have facilitated the research, and though, as is stated, "it is probable that the differences between the various members of the Crocodilia would be slight," we consider the method of treating a scientific subject on the principle "one is as good as another," a decided blemish. The figures of the muscular system, however, we are told, are "mainly from the Florida Alligator." The bionomical part of the book contains observations of much general interest ; Dr. Reese has found Alligator-meat decidedly palatable, and wonders why it is not more used ; the reptile has also much economic value as a leather-producer, hides of seven feet being most in demand. Compared with some old-world Crocodiles and with the American Crocodile (*Crocodilus americanus*), the Alligator is a very harmless reptile, and is even beneficial in keeping down Cane-Rats and Musk-Rats, so that, in view of its economic value, protective legislation has been suggested and is recommended.

Country Sights and Sounds. By G. T. ROPE. London : Constable & Co., Ltd. 1915. 3s. 6d. net.

THE sketches in this pleasant little book have, so the author tells us in his preface, mostly appeared in various publications concerned with nature, some in fact, in the 'Zoologist,' and Mr. Rope's useful and exhaustive contribution

last month on abnormal tastes in the Cat is evidence of genuine observation.

The manner in which he deals with some of his subjects, such as habits of homely domestic creatures like Fowls and Pigs—so generally neglected by modern naturalists—reminds one much of the inimitable style of J. G. Wood, a quotation from whose admirable 'Illustrated Natural History' faces the title-page. The author's writing, indeed, has no need of the modest apology contained in the preface, and although some of the chapters may fairly be called "slight," it would be most unfair thus to stigmatize the work as a whole. It is well got up, on rough paper—so much pleasanter to look at than the modern shiny stuff—and is not illustrated, a distinct point in its favour, for the subjects do not call for illustration, and nothing gives a more catchpenny aspect to a book than pictures which do not enlighten.

The Wonders of Animal Life. By W. S. BERRIDGE, F.Z.S.
London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd.
1915. 6s. net.

THE illustrations, on the other hand, are the main feature in Mr. Berridge's book; they number about a hundred, and, though far too generally lacking in definition, and so not very useful for giving an accurate idea of the mostly unfamiliar creatures they naturally represent, are for the most part very good in pose, testifying to plenty of patience on the part of the photographer. Some of the best are those illustrating the courting or other displays of birds; besides the familiar "show" of the Peacock and Turkey, we have here that of Peacock-Pheasant, Great Bird-of-Paradise, Sun-Bittern, and Great Bustard. Good photographs of such rare animals as the Tuatera, Royal Antelope, Tasmanian "Wolf" and Devil, are also welcome. Mr. Berridge's text is readable, though poor in style, and he covers a very wide field in his compilations; but he is sometimes deplorably careless, as when he calls the beaks of the Echidna and Platypus appendages to the snout, whereas they are the snout itself, and credits the male Apteryxes with being slightly larger than the females, when they are really very considerably smaller.

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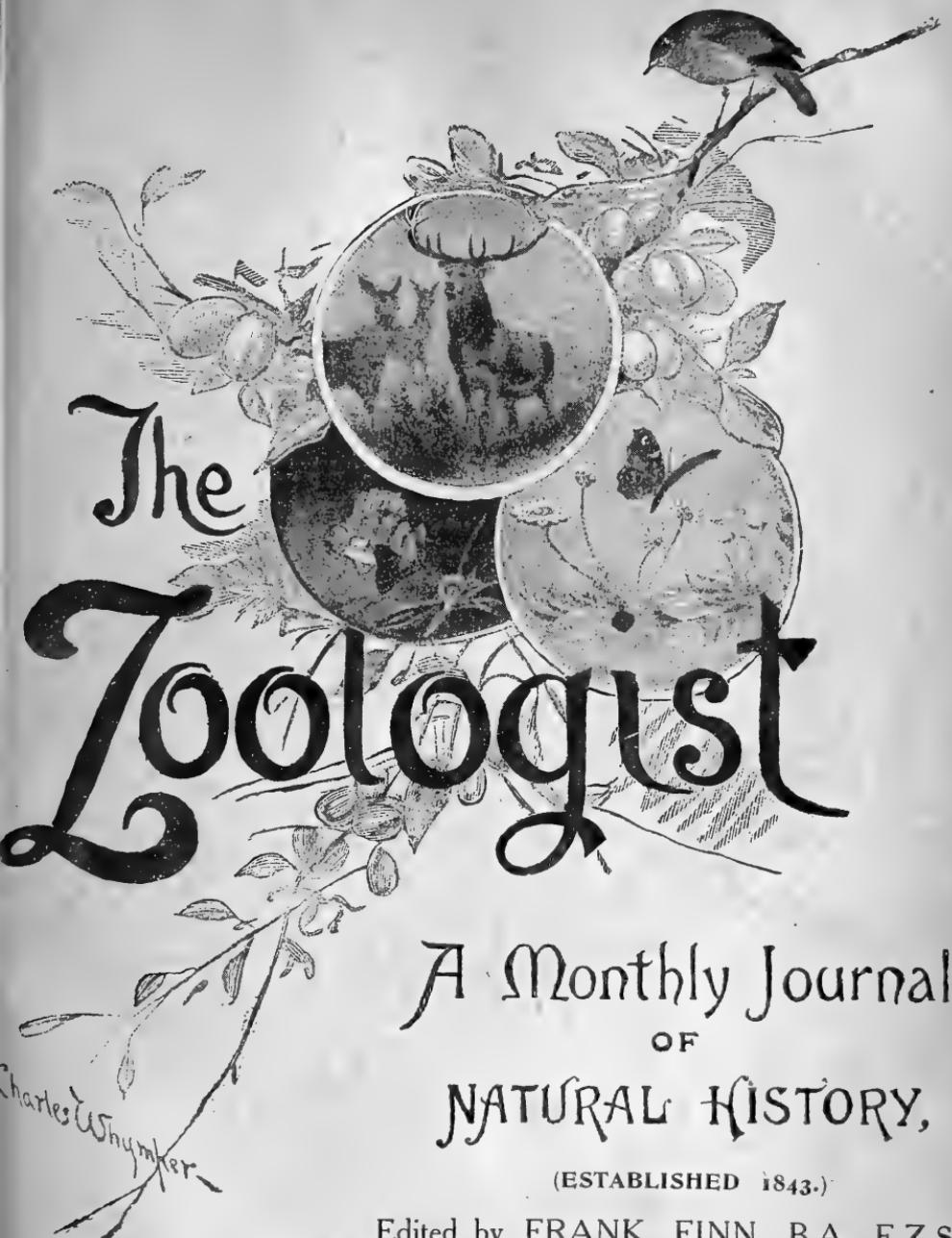
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OBSERVATIONS ON THE FOREIGN OBJECTS CARRIED BY THE PURPLE-TIPPED SEA-URCHIN.

By H. N. MILLIGAN, F.Z.S.

THE common Purple-tipped Sea-Urchin (*Echinus miliaris*) has a well-known habit of carrying various objects, which presumably act as a disguise, upon the upper parts of its body. These objects are usually stones, seaweeds, or shells, but the animal may pick up anything which lies in or close to its path as it creeps along, or which lies near its resting-place. In addition to pebbles and seaweed, I have seen the following materials carried by captive individuals of this Sea-Urchin: a bunch of about fifty eggs of the Sea-Bullhead (*Cottus bubalis*), a living *Ascidia* sp., a Tube-Worm (*Sabella pavonina*) of about seven inches in length, a Hydroid (*Sertularia operculata*), a living Dog-Periwinkle (*Nassa reticulata*), a living Dog-Whelk (*Purpura lapillus*), empty shells of *Nassa*, *Purpura*, *Rissoa membranacea*, *Trochus cinerarius*, and *T. zizyphinus*, fragments of the shells of various molluscs, and pieces of the broken test of the Edible Sea-Urchin (*Echinus esculentus*).

It seemed to me to be desirable, for reasons which will be mentioned later, to obtain a number of fresh Sea-Urchins, to keep them under constant observation, to make as far as possible detailed notes of their behaviour, and to keep records of the materials which they picked up. Twelve individuals were taken in a dredge from a part of the estuary at Walton-on-the-Naze (Essex) where there is a bottom of gravel. The long diameters (excluding the spines) of these Sea-Urchins were 10, 15, 19, 21, 21, 21, 23, 23, 23, 27, 27, and 39 millimetres respectively. The weights of the three first were 0·7, 1·7, and 4·3 grammes, the

average weight of the three individuals of 21 mm. was 5.6 gr.*; the average weight of the three individuals of 23 mm. was 8.0 gr.; the weight of those of 27 mm. was 12.7 gr.; the weight of the individual of 39 mm. (which was dead before the records were actually begun) was not taken. The Sea-Urchins were placed in an aquarium which stood in a fairly dark spot (lighted when necessary by an electric lamp above). This tank held nearly thirty gallons of well-aerated and gently-circulating sea-water, which as far as possible was maintained of a uniform salinity throughout the investigations. The floor of the aquarium was covered to a depth of about an inch and a half with small pebbles†; and the tank contained scattered rocks, seaweed, living gastropods (*Nassa reticulata*, *Purpura lapillus*, *Murex erinaceus*, *Trochus cinerarius*, and *Littorina littorea*), empty shells of these gastropods, several *Sabellæ*, and about twenty individuals of the Starfish known as *Asterina gibbosa*. The Sea-Urchins were well fed with raw beef and seaweeds, and were plentifully supplied with the broken shells and echinoderm skeletons which the Sea-Urchins eat in considerable quantities.

The aquarium was searched every morning (excluding Sundays), and any Sea-Urchin which was found to be carrying materials picked up since the last examination was removed from the tank, and the animal and the materials were weighed in a small vessel of sea-water. The observations were carried on for thirteen weeks, but as the results obtained were always of the same general character, it seems unnecessary to present more than a portion of the records made. During the first twenty-eight consecutive days (from June 30th to July 27th inclusive) eighty records of the kinds and weights of objects carried were registered, and these are as follows:—

* The individuals of 21 mm. were so much alike that it was difficult to distinguish between them, and the same remarks apply to those of 23 and 27 mm. The weights of all the Sea-Urchins differed slightly at different times. Average weights have therefore been given in all cases.

† If the convenient standards introduced by E. J. Allen ("On the Fauna and Bottom-deposits near the 30-fathom line, &c.," "Jour. Mar. Biol. Assoc.," vol. 5, N.S., 1897-9, pp. 365-542) are used, most of these stones would come under the head of "medium gravel" and "coarse gravel." Allen describes as coarse gravel the stones which are left in a sieve with holes of 5 mm., and as medium gravel those which are left in a sieve with holes of 2.5 mm. (p. 378).

SEA-URCHIN OF 10 MM. WEIGHING 0·7 GR.

No.	Objects carried.	Weights of objects.	Calculated proportion between weight of objects and weight of animal.
1	1 pebble	0·1	0·142
2	14 pebbles	1·1	1·571
3	4 „ piece of seaweed	0·5	0·714
4	4 „	0·3	0·428
5	10 „ piece of seaweed	1·1	1·571
6	9 „	1·0	1·428
7	21 „	1·8	2·571
8	15 „	1·9	2·714
9	12 „	1·2	1·714
10	10 „	1·0	1·428
11	12 „ piece of seaweed	2·4	3·428
12	9 „	1·0	1·428
13	4 „	0·3	0·428
14	9 „	1·2	1·714
15	13 „	1·8	2·571
16	8 „	1·3	1·857
17	11 „	1·0	1·428

Greatest weight carried, 2·4 gr.	Least weight carried, 0·1.	Average weight carried, 1·117.	Average proportion, 1·596.
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SEA-URCHIN OF 15 MM. WEIGHING 1·7 GR.

1	4 pebbles	2·5	1·470
2	2 „	0·7	0·411
3	1 pebble	0·1	0·058
4	5 pebbles	0·8	0·470
5	5 „	0·6	0·352
6	Empty shell of <i>Nassa</i>	0·8	0·470
7	8 pebbles	—	—
8	7 „	—	—
9	10 „	—	—
10	6 „	—	—
11	8 „	1·6	0·941
12	3 „ fragment of seaweed	0·2	0·117
13	3 „ „ „ „	0·2	0·117
14	5 „	0·7	0·411
15	Fragment of seaweed	—	—
16	13 pebbles	1·5	0·882

SEA-URCHIN OF 15 MM. WEIGHING 1.7 GR. (continued).

17	16 pebbles	1.6	0.941
18	12 ,, 	1.8	1.058
2.5	0.1	1.007	0.592

SEA-URCHIN OF 19 MM. WEIGHING 4.3 GR.

1	2 pebbles, operculum (? of <i>Purpura</i>) ...	0.5	0.011
2	2 ,, piece of seaweed, 12 cm. long, fragment of seaweed.....	2.7	0.627
2.7	0.5	1.600	0.319

THREE SEA-URCHINS OF 21 MM., EACH WEIGHING 5.6 GR.*

1	6 pebbles, empty shell of <i>Nassa</i>	3.5	0.625
2	1 pebble, empty shell of <i>T. cinerarius</i>	1.5	0.267
3	8 pebbles, empty shell of <i>Rissoa</i>	2.0	0.357
4	2 ,, 	—	—
5	Large mass of seaweed	4.0	0.714
6	4 pebbles, piece of seaweed	4.3	0.767
7	2 ,, 2 pieces of seaweed	3.0	0.535
8	9 ,, piece of seaweed	4.9	0.875
9	1 pebble	—	—
10	9 pebbles	2.8	0.500
11	10 ,, empty shell of <i>Purpura</i> ...	3.5	0.625
12	1 pebble	—	—
13	10 pebbles	1.4	0.250
14	9 ,, 	1.4	0.250
15	5 ,, 	1.9	0.339
16	12 ,, 	1.6	0.285
17	2 ,, 	—	—
18	5 ,, 	0.9	0.160
19	11 ,, 	1.0	0.178
20	1 pebble	0.5	0.089
21	6 pebbles	0.8	0.142
4.9	0.5	2.294	0.409

* For the reasons mentioned in the footnote on p. 442, these Sea-Urchins cannot be considered separately. The same remark applies to those of 23 and 27 mm.

THREE SEA-URCHINS OF 23 MM., EACH WEIGHING 8.0 GR.

1	9 pebbles	2.0	0.250
2	13 " living <i>Nassa</i>	4.5	0.562
3	13 " empty shell of <i>T. cinerarius</i> , Sea-Urchin of 10 mm.	3.5	0.437
4	1 pebble, empty shell of <i>T. cinerarius</i>	0.5	0.062
5	Piece of seaweed	1.0	0.125
6	1 pebble	0.3	0.037
7	Fragment of seaweed	—	—
8	4 pebbles	—	—
9	1 pebble	—	—
10	7 pebbles, fragment of seaweed	1.1	0.137
11	3 "	0.3	0.037
12	5 "	0.6	0.075
		4.5	0.191
		0.3	1.533

TWO SEA-URCHINS OF 27 MM., EACH WEIGHING 12.7 GR.

1	3 fragments of seaweed, piece of <i>Ser-</i> <i>tularia operculata</i>	0.1	0.007
2	3 pebbles	0.7	0.055
3	3 "	0.5	0.039
4	1 pebble	2.2	0.173
5	7 pebbles	2.7	0.212
6	Piece of seaweed	1.6	0.125
7	3 pebbles	0.2	0.015
8	5 "	2.4	0.188
9	2 "	0.2	0.015
10	1 pebble	0.2	0.015
		2.7	0.084
		0.1	1.080

Certain points, some of which are clearly brought out in the foregoing records, began to appear as the investigations proceeded. The records show, for example, that the proportion between the weight of the objects carried and the weight of the body of the Sea-Urchin was much higher in the smallest individual than it was in any of the others, and (if the individual of

19 mm. is excepted *), that there is a gradual decrease in this proportion in passing from the smallest to the largest, the series being 1·596, 0·592, 0·319, 0·409, 0·191, 0·084. They also show that objects were much more frequently picked up and carried by the smaller individuals than by the larger ones (again excepting the Sea-Urchin of 19 mm.), the number of recorded occasions on which the animals bore fresh materials during the twenty-eight days being 17, 18, 2, 7, 7, 7, 4, 4, 4, 5, and 5. Indeed, this latter difference would have been much more pronounced if it had not been that during the first eight days a source of error crept into the records; this was that the smallest Sea-Urchin, which disappeared soon after it was put into the aquarium, was found later to be really present on the floor of the tank, completely hidden by the pebbles which the animal carried. This Sea-Urchin was afterwards usually found by drawing a stick gently over the surface of the shingle, but on several mornings it could not be discovered even by this means. The individual of 15 mm. also was sometimes too well hidden to be detected. The larger ones, on the contrary, could always be seen in the first glance at the tank. Whilst the largest specimens (27 mm.) carried an average number of three objects, the smallest one (10 mm.) was almost always completely covered with an average number of nine to ten objects. The two smallest ones were very rarely found to be without objects, but the larger ones were often to be seen in this state, and the latter would sometimes allow several successive days to pass without bearing any materials.

The two small Sea-Urchins showed a very marked tendency to remain on or amongst the pebbles, the individual of 10 mm. being seen to climb up the face of a rock only eight times, and the one of 15 mm. only four times, in the thirteen weeks. The larger ones were in the habit of creeping freely all over the rocks, and upon the bottom, sides, and glass front of the aquarium.

* This Sea-Urchin was extremely sluggish, often remaining in one place (usually near the surface of the water) for several days in succession, though it seemed quite healthy. It was only seen to carry materials on five occasions in thirteen weeks. Its behaviour was probably abnormal.

There was also a striking difference between the smaller (10 and 15 mm.) and the larger (21 to 27 mm.) individuals in the manner in which materials were picked up. The small ones would proceed quickly to substitute other objects as often as their materials were taken from them, but the larger ones either neglected to do this or performed the operation in a less determined fashion. The records of three series of experiments out of a number will serve to illustrate this point.

1. The Sea-Urchin of 10 mm. was found one morning to be almost hidden beneath the nine pebbles, weighing 1.0 gr., which it carried. After these pebbles had been removed from the animal and weighed, the Sea-Urchin was put back into the tank. During the following fifteen minutes it covered itself with twenty-one pebbles weighing 1.8 gr. Twenty-two minutes later it had again completely covered itself with fifteen pebbles weighing 1.9 gr. A third time it covered itself, with twelve pebbles weighing 1.2 gr. It repeated the action a fourth time, but the number and weight of the stones was not ascertained. On the following morning the animal was found to be carrying ten pebbles weighing 1.0 gr. Nineteen minutes after removal of these it had picked up twelve stones and a piece of seaweed weighing 2.4 gr. Nine minutes afterwards it had nearly covered itself with nine pebbles weighing 1.0 gr. Its subsequent actions on this day were not noted. It should be pointed out that on each of these occasions the animal was closely watched, and was seen deliberately to pick up the pebbles, and with its spines and tube-feet to move them slowly from place to place on its body until it was hidden. Whenever the Sea-Urchin was returned to the aquarium after examination, it was not merely dropped into the water but was placed on the floor in its natural position, mouth downwards, in order that there should be no possibility of confusing the stones which were really picked up with those to which the animal merely fastened its tube-feet in the act of turning over.

2. Further experiments were made with the Sea-Urchin of 15 mm. Eight pebbles (weight not taken) were removed from its body, and in fifteen minutes it had picked up seven pebbles. It again covered itself with ten pebbles. Next day it was found to be carrying six pebbles (weight not taken), and when these

were removed it picked up eight pebbles weighing 1·6 gr. in eighteen minutes. Its further movements were not watched on this day, but on the following morning it was found to be carrying three pebbles and a fragment of seaweed weighing 0·2 gr. It again picked up these objects whilst it was being weighed in the small vessel of sea-water. Ten minutes after being replaced in the tank it had picked up five pebbles of 0·7 gr. Two minutes after removal of these it had picked up a piece of seaweed. As in the case of the Sea-Urchin of 10 mm., this specimen was always replaced in the aquarium with its mouth downwards, and was watched as it picked up each object. The manner in which these two small Sea-Urchins picked up fresh objects suggested that removal of the materials acted as a stimulus to pick up others.

3. The five largest Sea-Urchins were placed on the floor of the tank, after removal of any objects they carried. One deliberately picked up a piece of seaweed and carried it in the course of a few minutes to the anal region. One picked up four stones and carried them to the anal region in ten minutes. One picked up one pebble and carried it to the anal region in ten minutes. The two largest picked up one of them one pebble, and the other two pebbles, but each let its burden fall again almost immediately. Next day six large Sea-Urchins were deprived of any materials they carried, placed on the floor of the tank, and watched for half an hour. During this time an individual of 23 mm. picked up seven pebbles and a piece of seaweed weighing 1·1 gr.; one of 21 mm. picked up five pebbles of 0·9 gr.; another one of 21 mm. picked up eleven pebbles of 1·0 gr.; and three of them (of 23, 27, and 27 mm.) did not pick up any objects. One of the Sea-Urchins of 27 mm., which persistently crept away to ascend the vertical side of the aquarium, was replaced on the pebbles on three successive occasions, but on none of them did it attempt to pick up anything.

The evidence derived from the observation of these eleven Sea-Urchins suggests that the habit of carrying foreign materials is gradually lost as the animal grows bigger.* There would

* R. Elmhirst ('The Naturalist at the Seashore,' 1913, p. 33) mentions that the Edible Sea-Urchin (*E. esculentus*) occasionally dresses itself with materials, "especially young ones."

certainly seem to be more need of protection for the smaller than for the larger individuals, because an animal which might easily manage to eat a Sea-Urchin of 10 mm. possessing comparatively small spines, might not be able to eat one of 30 or 40 mm. with a formidable mass of spines.

It was to be noted that if any objects at all were carried by a Sea-Urchin, these objects were nearly always held so that they covered the anus of the animal. This was well seen in the case of the large individuals, and was particularly striking when one of them carried only one or two pebbles. In one hundred and ten successive examinations of loaded Sea-Urchins it was found that in ninety-six cases the materials were so arranged that they covered the anus, while in the majority of the other fourteen cases they were carried close to it. It would seem that while a Sea-Urchin gradually loses the habit of carrying a mass of objects, it retains that of carrying sufficient to cover the anal parts, and this habit (observed in other examples besides these eleven) seems to demand an explanation.

When a Sea-Urchin is watched as it creeps with its load along a horizontal surface, a sufficient explanation would seem to be that the animal instinctively places the objects on the part where they are most easily carried, that is, on the flattened upper pole of the animal. But this explanation is seen to be inadequate when it is remarked that Sea-Urchins carrying materials are to be seen in a vertical position quite as often as they are in a horizontal one, and that it has several times been observed in the tank that a Sea-Urchin in a vertical position will proceed to transfer to its anus a stone laid upon the uppermost part of the animal. The true explanation may perhaps be that in the living* Sea-Urchin the well-marked anal region, with its palisade-like circle of spines, readily catches the eye of a predatory fish, and must therefore be hidden. Again, when the Sea-Urchin is defæcating, the successive pellet-like faeces attract attention as they fall down the animal after being thrown out of the anus, and the presence of a pebble or other object (which is usually held, by the spines or tube-feet or both, at a little height

* In a dead Sea-Urchin, owing to the irregular way in which the spines are disposed, this eye-like anal region is by no means so conspicuous as it is in the healthy living animal.

above the anus) might serve to confuse an enemy as to whence the rolling pellets came. Fishes and Starfishes seem to be the chief enemies of Sea-Urchins.* Defence by disguise may be effective against fishes, but it would probably be of little use against the Starfishes, which find their food by scent. When a sluggish or dying Sea-Urchin is attacked by *Asterina gibbosa*, as sometimes happens in the aquarium,† the asteroid "sits" over the anus or mouth of the echinoid, and then slowly digests and breaks a way through the anus, or the membrane surrounding the mouth.‡ Two or three stones or other objects might therefore be of service to the Sea-Urchin in preventing the Starfish

* The following are some of the published observations as to the enemies of Sea-Urchins. Rymer Jones ('The Aquarian Naturalist,' 1858, p. 203) states that small *Echini* form part of the food of the Common Starfish. Ludwig (in Bronn's 'Thier-Reichs,' Echinodermen, Buch iv. 1904, p. 1302) mentions that remains of *Echinus* have been found in the Haddock, *E. miliaris* in the Grey Gurnard and Plaice. According to Todd ("Notes on the Invertebrate Fauna and Fish-food of the Bays between the Start and Exmouth," 'Jour. Mar. Biol. Assoc.,' vol. vi. N. S., 1900-3, p. 558) remains of *Echinus* have been found in the Dab. Eichelbaum ("Über Nahrung und Ernährungsorgane von Echinodermen," 'Wissensch. Meeresunters. Kiel, N. F.,' Bd. 11, 1910, pp. 190-200) found remains of Sea-Urchins in various species of Starfishes. Schiemenz ("How do Starfishes open Oysters?," translation by Allen in 'Jour. Mar. Biol. Assoc.,' vol. iv. N. S., 1895-7, p. 268) saw a moderately large Sea-Urchin attacked by two individuals of *Asterias glacialis* in the aquarium at Naples. Franz ("Ueber die Ernährungsweise einiger Nordseefischer besonders der Scholle," 'Wiss. Meeres. Helgoland, N. F.,' vol. ix. 1910, pp. 201 and 202) found pieces of Sea-Urchins in the Wolf-fish, and *Gadus minutus*, &c.

† This was the case with the individual of 39 mm. when it was dying, and also with an individual (not belonging to the eleven) of 26 mm.

‡ I have not seen the larger Starfishes attacking a Sea-Urchin, but it is possible they would sit over the same parts. Schiemenz (*loc. cit.*) speaks of the clever way in which the two Starfishes at Naples forced their stomachs through openings which appeared little adapted for the purpose; one threw its stomach into the narrow space between spines, and the other attacked the mouth, of the Sea-Urchin. Before my observations on the Sea-Urchins were begun, I had found by experiments that if an *Asterias rubens* was given a dead fish, in whose abdomen a small opening had been made with the point of a knife, the asteroid would pass its stomach through the opening and search the interior of the fish. The asteroid would also pass its stomach through a puncture made in the abdomen of a dead Hermit-Crab.

from fixing its everted stomach tightly upon the anus of the echinoid. It may be that whilst the Sea-Urchin is able gradually to give up carrying a mass of protective or disguising materials, because the larger it grows the less liable it is to attack, it is still compelled to protect or hide one vulnerable spot.

These and other considerations gave rise to some experiments to decide (1) whether the larger Sea-Urchins would always pass objects from outlying parts of their bodies on which the objects had been laid to the anal region, and (2) the length of time taken in this transference. Some facts which bear upon these two points have already been incidentally mentioned (p. 448). In one series of experiments, made in one morning, six Sea-Urchins were used. An empty *Nassa* shell held against the periphery of a horizontal Sea-Urchin of 23 mm., just above the level of the ground, was retained by the animal and carried to the anus in four minutes. A pebble held to the periphery of a horizontal specimen of 21 mm. was grasped, carried across the upper surface of the body, and let fall on the other side in three minutes. A specimen of 23 mm., clinging to the vertical face of a rock, took a stone at the same part, passed it around the edge of its body, and dropped it, in three and a half minutes. An empty shell of *Trochus cinerarius* placed directly in front of, and about a quarter of an inch away from, a Sea-Urchin of 27 mm. advancing along a bare horizontal rock, was picked up when the animal touched it and passed over to the anus. Six and a half minutes elapsed from the moment of placing the shell to the moment it reached the anus. A Sea-Urchin of 23 mm., climbing up the vertical face of a rock, retained a pebble which was given to it, and carried the stone to the anus, in ten minutes. An empty shell of *Nassa* placed loosely upon the uppermost part of a Sea-Urchin of 27 mm., which was climbing up the vertical face of a rock, was allowed to fall. As a rule a Sea-Urchin, even if it does not want to retain an object, will pass it across its body in order to drop it, but in this instance the animal raised the uppermost part of its body, let the shell pass down between its oral surface and the face of the rock, and then, lifting the lowermost part of its body, allowed the shell to slip to the bottom of the tank. This operation took nearly two minutes. Another series of experiments was made a few days

later. A Sea-Urchin of 27 mm. was given a pebble which it carried, not quite as far as, but nearly to, the anus, where it was retained, in twelve minutes. The other individual of 27 mm. carried a pebble given to it for about half the distance between its periphery and its anus, where the stone was held, and no further progress was made during the following half hour. A Sea-Urchin of 23 mm. carried a pebble from the periphery to the anus in fifteen minutes. Flattish stones of about 5 mm. were used in the experiments. The foregoing observations seem to me to suggest that, if it is going to carry the objects at all, the Sea-Urchin deliberately directs them towards its anal region.

The chief facts recorded in this paper, and the inferences which may, I think, be fairly drawn from them, can be summarized as follows:—1. The proportion between weight of objects and weight of body is greater in the smaller than in the larger Sea-Urchins. 2. Objects are more frequently picked up by the smaller animals. 3. The smaller ones substitute objects for those which have been removed from them more certainly, quickly, and determinedly than do the larger ones. 4. The habit of carrying numerous objects is probably lost with age, but that of covering the anus is retained. 5. The objects are usually arranged so as to cover the anus, even if the other parts are left exposed. 6. The probable uses of the objects over the anus are: (a) to hide the eye-like anal region; (b) to confuse an enemy as to the place from whence the faeces issue; (c) to keep off the stomachs of Starfishes. 7. Objects picked up are usually transferred to the anus.

It formerly seemed to me to have been too readily assumed that foreign objects were picked up and carried by the Sea-Urchin for purposes of disguise. Some of the objects (such as living molluscs) even seemed likely to attract carnivores which might attack the Sea-Urchin itself, whilst others (such as one tiny pebble on a large individual) seemed to be entirely useless. Again, the peculiar locomotory organs of the Sea-Urchin had to be taken into account. These and other considerations raised the question whether the Sea-Urchin really possesses an instinct which prompts it to pick up materials which will act as a disguise, or whether the animal in creeping along, or in climbing, or in steadyng itself, affixes some of its tube-feet to loose neigh-

bouring objects, and simply neglects to drop them again. It was to satisfy myself on this matter that the investigations herein described were really undertaken, and it was not until they had been in progress for some time that my attention became fixed upon the other points explained in this paper. The above-mentioned instances (pp. 447-8) in which the two small Sea-Urchins covered themselves with objects in their energetic and determined manner on several successive occasions proves that the picking up of materials is not merely accidental or incidental. There now appears to me to be little doubt that the Sea-Urchin has the instinct in question. Disguise, however, is probably not the only use of the objects. Another important use may be the resistance which they offer to fixation upon the Sea-Urchin of the everted stomach of a Starfish.

THE PHARYNGEAL TEETH OF FISHES.

By COLONEL C. E. SHEPHERD (Indian Army).

(Continued from p. 105.)

NANDIDÆ.

Nandus marmoratus, an Indian fish, has eight tubercle gill-rakers on the outer edge of the first cerato-hypobranchial, the eighth one from the angle being long in shape, equaling three of the others in length. The inner side of this arch has seven independent little gill-rakers. There are four on the outer side of the first epibranchial. The outer and inner sides of the second and third arches and the outer side of the fourth arch have similar gill-rakers, but rather smaller than those of the first arch. All these gill-rakers carry very minute but palpable teeth. There is a group of cardiform teeth at the junction of the second arch with the basibranchials. The upper pharyngeal teeth are in two groups on each side. They are well-defined cardiform teeth. The lower pharyngeal teeth are on two long plates and are smaller cardiform teeth than the upper.

PERCIDÆ.

Perca fluviatilis (the Perch) has twelve horny gill-rakers on the cerato-hypobranchial of the first arch, with three rudimentary ones at the end, and three rudimentary ones on the first epibranchial. The gill-rakers of the other arches are tubercles. The horny gill-rakers bear teeth; the length of the longest of the gill-rakers is about equal to the depth of the gill-laminæ below it. The upper pharyngeal teeth show as three distinct groups on the heads of the second, third, and fourth epibranchials of minute teeth. The lower pharyngeal teeth are on two long plates of even more minute teeth.

Acerina cernua (the Pope, Ruff, or Jack Ruff) has eight small tubercle gill-rakers on the cerato-hypobranchial of the first arch, with one on its epibranchial. The other arches have similar tubercles each side that fit into each other, forming a good filter apparatus. The upper pharyngeal teeth show as in three groups of minute teeth each side. The lower pharyngeal teeth are in a V-shaped group of minute cardiform teeth.

SILLAGINIDÆ.

Sillago sihama, called the "Whiting" at Madras, where it is an esteemed table fish, has twelve long horny gill-rakers on the cerato-hypobranchial of the first arch, the longest nearly equal in length to the depth of the gill-laminae below it. The inside of the first arch and both sides of the other arches have tubercle gill-rakers that fit in alternately but not very closely together; the filter they form is not a close one. The upper pharyngeal teeth are in a narrow band on the second epibranchial, and in a broad patch formed of two groups on the heads of the third and fourth epibranchials. These teeth are very minute. The lower pharyngeal teeth are in two broad triangular groups of similar minute teeth.

CAPROIDÆ.

Capros aper (the Boar Fish) found occasionally on the English coast, has its upper pharyngeal teeth arranged in three distinct rows of fine cardiform teeth. They form three parallel rows. The lower pharyngeal teeth are villiform.

OSPHROMENIDÆ.

Osphromenus olfax, the Gourami of the Malay Archipelago, one of the most esteemed fishes for the table, has ten short, triangular-shaped, rather soft gill-rakers on the outside of the cerato-portion of the first branchial arch. Their shape is approximately equilateral, the height of the one nearest the angle of the branchial arch being one half the depth of the gill-laminae below it. The inner side of the first arch, both sides of the other gill-bearing arches, and the outer side of the fifth arch are covered with numerous soft gill-rakers that fit closely into each other from opposite sides, forming a perfect filter apparatus. The upper pharyngeal teeth are in two groups each side, the upper one crescentic, the lower circular in shape; they are separated by a broad band of mucous membrane. The teeth show as little black-brown specks, and are cardiform. The lower pharyngeal teeth are in a broad band right across the mouth, are likewise blackish, cardiform, and rather sparsely spread about. The lower pharyngeal bones are separate.

Osphromenus trichopterus, also from the Malay Archipelago, has a large number of soft, small gill-rakers so close together as not to admit of being accurately counted; they appear to form a

narrow ribbon on the edges of the branchial arches, and fit so closely as to make a very efficient filter. The upper pharyngeal teeth are represented by two soft circular patches of concentric circular corrugations round a central nucleus of papillæ. The plan of the lower pharyngeal teeth is occupied by soft papillæ.

EMBIOTOCIDÆ.

A family of viviparous fishes frequenting the North Pacific Ocean.

Neoditrema ransonettii, a fish from Japan, has sixteen horny gill-rakers on the cerato-hypo of the first branchial arch, the longest of these about two-thirds of the depth of the gill-laminæ below it; there are six similar ones on the first epibranchial. Those on the cerato-hypo portion bend over in the forward direction, and have soft bristle-like projections on them. The other arches have tubercular gill-rakers that fit in from opposite sides and make a close filter. The upper pharyngeal teeth are in two groups, one each side, of strong conical teeth set close together. The lower pharyngeal teeth are in a triangular group, set across the floor of the gullet, of similar teeth, the row nearest the œsophagus being rather larger than the others. The lower pharyngeal bones are united. (See fig. I., 1, which has been enlarged to twice the natural size to show the teeth more clearly). The top of the gullet has been divided, and folded sideways each side, to enable the lower pharyngeal teeth to be more clearly seen. This had to be done also with the illustration of the pharyngeal teeth of the *Labridæ*.* The similarity in the pharyngeal dentition would point to a similar molluscan and crustacean diet.

Hystericarpus traski, a fish from California, has eight horny, moderate-sized gill-rakers on the first cerato-hypobranchial arch, and seven on the epibranchial. The length of the longest is about half the depth of the gill-laminæ below it. The inner side of the first, and both sides of the second, third, and fourth arches are set with tubercle gill-rakers that fit in from opposite sides and form a close filter. The upper pharyngeal teeth show as a roughly circular group, on each side, of conical teeth with some in their middle of a rounded granular shape, possibly due to their being more ground down; they are the largest in the

* See 'Zoologist,' December, 1911, p. 454.

group. The lower pharyngeal bones are united, and carry a group of pavement-like teeth; at the back and in the middle they are of large size and show marks of grinding action; on the outer sides of the middle ones and coming towards the apex of the triangle are smaller conical teeth (fig. I., 2).

Ditrema temminckii, a fish from Tokyo, Japan, has twelve long horny gill-rakers with small bristles on their inside edge; three are rudimentary ones, all on the cerato-hypo portion of the first branchial arch with six on the epibranchial. The length of



FIG. I.

NEODITREMA RANSONETTII. DITREMA TEMMINCKII. HYSTEROHYPOTHYROIDUS TRASKI.

the longest one equals the depth of the gill-laminae below it. The other arches have tubercle gill-rakers fitting closely and making a good filter. The upper pharyngeal teeth consist of a small row of soft bristles on the head of the second epibranchial, and a roughly circular plate of strong conical teeth set closely together on the heads of the third and fourth epibranchials. The lower pharyngeal bones are united and carry a triangular group of conical teeth set very closely together, small at the front apex and getting larger posteriorly, the last row being comparatively large (fig. I., 3).

(To be continued.)

THE RELATION OF THE OYSTERCATCHER TO ITS NATURAL ENVIRONMENT.

By J. M. DEWAR, M.D.

(Concluded from p. 431.)

VIII.—THE OPTIMUM HABITAT IN WINTER.

On the south side of the Firth of Forth three areas carry large stocks of Oystercatchers. These areas are chiefly, or entirely, mud-flat habitats. The remaining four areas, coming under observation, are rock-beach habitats, and they carry small stocks. As it has not been possible to determine the total quantity of Mussels available in each area, and as periodic estimations of the numbers in each stock, excepting those of the small stocks, proved disappointingly variable, the direct method of comparing the numbers of the birds with the size of the *Mytilus* areas, where they feed, could not be used. Recourse was had to other means.

I have elsewhere* stated, from fairly extended observations, that the Oystercatcher is unable to open tightly-shut Mussels, unless it can reach the byssal cleft, or the Mussels are small enough to be crushed. The former possibility occurs infrequently, Mussels opened through the straight border forming only nine per cent. of the opened shells examined. The latter is apparently avoided, whenever possible, and the birds reject Mussel-flesh mixed with fragments of shell. Dryness of the surroundings brings about a tight closure of the shells, and follows shortly after the tide has receded from the scalps. The birds are then confined in their search to the tide-line, pools, under seaweed, and under mud near the scalps; a hunt for Mussels presenting the straight border, and the hammering of small Mussels being evidently the last resort. Mussels that become covered with mud are soon killed, and are never numerous; their presence under seaweed is accidental; while *Mytilus* is predominantly not a pool-dwelling form in the littoral zone. The principal search must, therefore, be confined to the margin of the tide.

From these considerations it is evident that the ultimate bearing capacity of a *Mytilus* station is directly determined by

* 'Zoologist,' 1908, p. 201; 1913, p. 41.

the quantity of Mussels available in the water margin during successive phases of the tide, and not by the total number of Mussels on the station ; and that, other things being equal, the longer, that is, the more sinuous the contour lines, and the more shallow the gradients of the station—the greater the number of Oystercatchers a given area will support. These requirements are fulfilled better by the mud-flat than by the rock-beach habitat. In the former, the presence of banks and the extreme shallowness of the gradients cause a comparatively large area of the Mussel-scalp to be kept in a moist condition at all states of the tide within the *Mytilus* zone. As a result, the birds have not only a long contour line along which they can extend, but also, owing to the great breadth of shallow water, they can work over a greater area, and in several rows, or even in masses. In general, contrary conditions prevail on the rock-beach. The greater steepness of the gradients and the shortness of the contour lines narrow and reduce the length of the zone available at a given time, so that it is unusual to observe the birds in more than single file in the tide-line, after drying of the exposed Mussels. Other circumstances favour the mud-flat habitat. The Mussels run to larger sizes than on the rock-beach, and provide a greater proportion of those sizes most usually taken by the Oystercatcher. The exposure to the effect of storms is negligible on the mud-flat. Wave-action here does not interrupt the operations of the birds. The rock-beach has mostly a great, or severe, exposure to storms, and in bad weather, which in winter may last for days, wave-action interferes with search in the tide-line, and in some places may render whole feeding-grounds entirely inaccessible. Exposure of the rock-beach to severe wave-action is a necessity for the existence of *Mytilus*, for wherever the rocks occupy sheltered positions, the growth of weed is excessive and Mussels are absent. The mud-flat habitat is not drawn upon by Diving Ducks, which devour large quantities of Mussels on the rock-beach habitat ; there being here a different time-distribution in the community, the Ducks operating towards high water and the Oystercatcher towards low water on the same feeding-grounds. Owing to the great area exposed on the ebb and the uniformity of the surface, the mud-flat is more favourable to the Oystercatcher in regard to human in-

trusion. The rock-beach, even when it takes the form of skerries, has less depth of foreshore, and a variety of surface features, which, in some places, are a direct assistance to human approach.

On these grounds the mud-flat is regarded as an optimum habitat of the Oystercatcher, on the south shore of the Firth of Forth, in so far as food activities are concerned. It is obvious, however, that a mud-flat will not form an optimum habitat in a district having a large human population, unless it has attached to it a place of refuge, available during high water and at other times, when the feeding-grounds are disturbed. There are other non-essential conditions of which one—the wet sand-beach—has been definitely recognized.

In more general terms, the conditions of an optimum habitat in winter are: (1) a body of sea-water; (2) edible Mussels in sufficient quantity and of a suitable size (mostly not under 2·5 cm. in length), stationed on an area which has shallow gradients and sinuous contour lines, and which is not exposed to severe wave-action; (3) areas of soft wet sand near to the feeding-grounds, attractive in connection with the crowding and other reactions. Wherever the presence of man makes itself felt, there fall to be added: (4) separation of the feeding-grounds from the nearest potential source of danger by a distance of, at least, 150 metres; and (5) a place of refuge which is not too far away, and affords a considerable amount of security during the period of high water, and in the event of human disturbance of the feeding-grounds.

In the Firth of Forth, the large human population of its banks is, on the whole, adverse to the Oystercatcher as a species. Extensive feeding-grounds exist on both shores, which are seldom visited, and which, as far as can be seen, would adequately support a larger stock of birds than that, at present, inhabiting the whole estuary. The destruction wrought each winter on the resident stocks is so slight as to be imperceptible in the mass. This fortunate circumstance is solely due to the fact that the territories, which are inhabited, provide the conditions which make it very difficult to bring the birds within range of the gun.

IX.—THE OPTIMUM HABITAT IN SUMMER.

About fifty pairs are estimated to breed yearly in the lower reach of the Tummel between Pitlochry and Ballinluig. For

the 9.5 kilometres of river this gives one pair per 190 metres. On the Garry between Blair and Killiecrankie, the number of pairs is more difficult to estimate, on account of the locally abnormal habits already mentioned. It is believed to be about ten in the 4 kilometres of river, and is equivalent to one pair per 400 metres. The south side and east end of Loch Tummel are occupied by eight to ten pairs (nine in 1912), equal to one pair per 490 metres. The number of pairs found yearly in the 2 kilometres long, tree-stump area in Glen Fender is three—that is, one pair per 670 metres. On the 3.2 kilometres of the River Orchy between Loch Tulla and the bridge, two pairs are stationed (1909, 1910), being equal to one pair per 1600 metres.

The River Orchy is a fairly large river with large areas of light grey shingle. The glen is open and is occupied by a very small human population. The soil is inferior and suitable only for sheep-pasture. There is little cultivation. The birds, therefore, have to depend on the river banks and the hillside for their feeding-grounds. The supply of worms and larvae is not so plentiful as it is on the Tummel.

The hill-stream habitat comes next in an ascending order. Its low grade value is probably due to elevation above sea-level (230-305 metres), which certainly restricts the area under cultivation, and probably affects the supply of worms and larvae as well. The local feeding-ground comes within the normal range of the Curlew, and much of the area being marshy, there is also a large number of Snipe. Both of these birds compete with the Oystercatcher in the subterranean ground stratum of the local feeding-ground. The hill-stream habitat is peculiar in the sense that it owes its occupation by the Oystercatcher, not, it would appear, to the presence of the Fender Burn and other common elements of an occupied station, but to the large number of bleached tree-stumps scattered over the local feeding-ground. The young assimilate in colour to these stumps, which are frequently associated with the crouching response. The stumps also contribute to the food supply. The area has great breadth, and the shingle-beds in the burn course are small. The young are led much greater distances away from the shingle than is usual in other stations, and the reason which makes this possible appears to be, the tree-stumps afford protection to the young,

which especially as they grow older, seldom retreat to the shingle in the event of human or other intrusion. A later stage of the same kind of area is seen on the Cragan Dubh alluvial cone on the south side of Loch Tummel. Here the local feeding-ground on the cone is dotted over with mossy hillocks, under which, and completely covered by the vegetation, are very ancient stumps of trees. The station continues to be occupied yearly by a pair of birds, and young are usually reared, but the old tree-remains have no evident biological significance to either old or young of the Oystercatcher. The Cragan Dubh cone, though small, is a comparatively rich area, and the young do not need to be led far. The wide range of the young in the Fender area appears to be due to relative poverty of the food supply, and is undoubtedly rendered possible by the protective value of the tree-stumps. When these are covered over by vegetation at a future date, a change may be expected in the distribution or range of the birds.

Next in the sequence comes the lake-beach habitat, as represented by the south shore of Loch Tummel. The conditions here are, on the whole, favourable to the occupants and to the rearing of the young, but the size of the population is evidently controlled by two factors, of which one is the relative narrowness of the shingle beaches which are not greatly favourable, on that account, to the concealment of the eggs or the young, and the other is the limitation of the local feeding-grounds to the discontinuous alluvial cones, for suitable local feeding-grounds do not occur elsewhere.

The portions of the Garry and Tummel under observation have a higher population per kilometre than any of the other areas. In this respect they show a pronounced difference from the other representative of a river-valley habitat, already described. Using a salient and ecologically important feature, it is, therefore, proposed to distinguish a river-valley habitat, such as the Orchy, from a drift-river-valley habitat, of which the lower reaches of the Garry and Tummel are representatives. In these areas the drift, or boulder-clay, covers a large part of the ground, and is largely cultivated. With the drift, as of importance for the Oystercatcher, must be associated the large deposits of alluvium which determines the distribution and area of the

local feeding-grounds. The drift and the alluvium are more favourable to the existence of the animals on which the Oystercatcher feeds, than the poor soil of the denuded river-valley. Cultivation follows the distribution of the drift and further increases the food-supply. But cultivation means human occupation, which is generally destructive. Cultivation, therefore, operates in two opposite directions in controlling the ratio of Oystercatcher population. Cultivation tends to increase the numbers of the stock an area may carry, and, at the same time, it is constantly tending to reduce the stock by means of human interference. Evidently, a balance has been struck, as the Oystercatcher population shows little or no change from year to year. The ratio of stock on the Garry to that on the Tummel is about 1:2. The most evident differences between the two areas are the smaller size of the Garry and its shingle areas, and the larger agricultural population. The smaller shingle-beds on the Garry are less favourable to the safety of the eggs and young than is the case on the Tummel. But, even on the large shingle areas at Moulinearn and Ballinluig, there is seen a tendency to desert the shingle for the river-bank, and the connection between this phenomenon and human interference is well established. Nesting in unusual places is general in the Vale of Atholl, but it must be fairly successful, as no diminution in the local stock has been recognized. Here the abnormal behaviour is probably connected with the semi-public character of the shingle and the large human population, the Vale of Atholl being the most populous district in the area under observation. It would appear as if, under the present secondary conditions of the river-valley, a too large human population outweighs the advantages which drift, and cultivation by a moderate population, confer upon the Oystercatcher.

Owing to the erratic nesting behaviour in the Vale of Atholl no reasonably complete figures could be obtained for the ratio of families to nests, and hence no comparison of the breeding results in the Garry area with those on the Tummel is possible. The results obtained at Loch Tummel, however, show that the relatively moderate stock on the south shore of Loch Tummel, as compared with the relatively large stock carried by the lower part of the river Tummel, is not due to greater difficulties in rearing young.

In 1912, nine pairs on the south shore and the storm beach of Loch Tummel produced four families of altogether nine young. In 1914, eight pairs produced three families of $4 + X$ young (probably seven). On the river Tummel, in 1909, at Moulinearn, eleven pairs had five families of eleven young. On the Logierait, upper island station, in 1910, ten pairs had four families of eight young, and in 1912 eight pairs had three families of six young. The ratios of adults to young in the two habitats are, therefore, approximately similar, being about $2\cdot2:1$. These two habitats are equivalent in human population and in amount of human intrusion in the territories. But the ratio of stocks in the two areas is relatively high, being as 2.5 on the river to 1 on the loch. The control of the Oystercatcher population in the two areas must, therefore, be sought in the factors already given, namely, the size and distribution of the shingle areas, alluvium, and boulder-clay. These three factors are equivalent on the Garry and the Tummel, except in total area. The size of the total area, when continuous as it is on these rivers, ought not to affect the linear distribution of the birds. The cause of the lesser population per kilometre in the Vale of Atholl may, therefore, with a fair degree of probability, be referred to the greater human population.

Thus, on the basis of population ratio and other considerations already mentioned, the drift-river-valley may be regarded as an optimum habitat in summer, within the area placed under observation. In some, the prevailing conditions of an optimum habitat in summer are:—(1) A breeding area and refuge, of sufficient extent, close to a body of water, rising well above summer flood level, devoid of vegetation, assimilating in colour appearance to the eggs and more especially the young, and fairly secure from human and other enemies.

(2) A local feeding-ground of sufficient area, to which the young have access on foot, terraced to form two adjacent levels so that, when the birds are on one level, they cannot readily be seen by an enemy from the other, covered with old turf, rich in tipulid and coleopterous larvae, together with at least a moderate supply of earthworms, and fenced in, or in other ways protected from disturbance; both the breeding area and the local feeding-ground being held as territories, and situated on that account not too near the habitual stations of "barren pairs."

(3) A distant or general feeding-ground resting on boulder-clay or alluvium, and preferably cultivated, to which the adults may resort for food, and from which they may bring a large supply of large earthworms to the young. Auxillary conditions which have some value are :

(4) The presence of a wet sand-beach in some part of the breeding territory ; and

(5) An abundance of Stonefly nymphs, along the river margin, at the time when most of the young Oystercatchers escape from the eggs.

RESUMÉ AND CONCLUSION.

The general results of the inquiry point to the mud-flat in winter, and the drift-river-valley in summer as optimum habitats within the areas under observation. The presence of a large human population has a pronounced effect on the distribution and numbers of the Oystercatcher. The Law of Territory is shown to be valid for the Oystercatcher, both in winter and in summer. The arrangement and extent of the territories, and the general movements of the birds therein, remain the same year after year. The theory of the biological advantage, or necessity of conserving the food-supply for the exclusive use of the settlement, by the maintenance of territorial rights, is supported by observations made at one winter station, where the food-activities of the settlement were found to strain the reproductive powers of the shellfish of the area. In relation to climatic conditions certain activities, normally successful, become ill-regulated when they are elicited at an abnormal period. The intangible associational barriers of Grinnell prove to be fully applied to the Oystercatcher, both in winter and in summer. They are (1) kind of food-supply afforded ; (2) presence of safe breeding-places, and (3) presence of places of temporary refuge for individuals, when hard pressed by predatory enemies.* The last condition, though long known, had not previously been given the formal position its importance deserves among the factors of distribution. In summer for the young, and in winter for the settlements of the Oystercatcher, places of refuge are an important factor controlling distribution in the areas under observation.

* Amer. Nat. 1914, vol. 48, p. 252.

NOTES AND QUERIES.

MAMMALIA.

Whale on the Lincolnshire Coast in the Seventeenth Century.—It will no doubt be generally agreed that all notes in non-zoological literature of occurrences of cetaceans on or off the coasts of the British Isles ought to be reproduced, for future reference, into the pages of the 'Zoologist'; and I therefore offer the following quotation from a letter dated "March 25, 1692-3," and signed "Westmorland," the writer being probably Rachel, wife of Sir Vere Fane who became fourth Earl of Westmorland. The letter is published in full in 'The Ancestor,' xi. (Oct. 1904), p. 150:—"Thare is a great whale com a shore in lincornshire of a prodidous bigth so that a man of six feet hiy may stand uprite in his mouth & it is sold for a thousan pound." Of course no Whale ever yet calved was of such "a prodidous bigth" that a man six feet "hiy" could stand upright in its mouth, but if we for the moment ignore the palate and all the contents of the enormous head above it, a large Sperm Whale might be suggestive of the possibility. The next choice would lie with a Greenland Right Whale, but as this species has never been known to move far from the ice, it may safely be assumed that no example ever came ashore in Lincolnshire. The Nordkaper or Biscayan Right Whale comes a bad third, and the Rorquals nowhere. So there can be little doubt that this Whale was a Sperm. The late Mr. T. Southwell gives several instances of its occurrence on the British coasts in his 'Seals and Whales of the British Seas,' and several have been killed during the last few years by the Finwhalers working off the Shetland coast; but of course it is very far less numerous now than it was one, two, or more centuries ago. The large sum for which the carcase is said to have been sold (and representing an even larger amount at the present value of money), though it may well be an exaggeration, would certainly indicate either a Sperm or a Right Whale; the biggest Blue Rorqual would not have fetched nearly so much.—**ALFRED HENEAGE COCKS** (Poynetts, Skirmett, near Henley-on-Thames).

A V E S.

Rough-legged Buzzard in Suffolk.—Driving along the road at Friston, Suffolk, on November 4th, I had the great pleasure of seeing

and watching for a short time a couple of these fine birds on the wing. They were, too, at no great distance, and one of them came down so low that the light-coloured plumage and white tail-coverts were plainly visible. Their flight was magnificent, as, with their long wings at full stretch, they were sailing grandly in large circles, above some ground thinly covered with young trees. It has long become a rare treat to see here in East Suffolk any large raptorial bird on the wing, and the pleasure of doing so is always damped by the knowledge that it will in all probability soon be rotting in some "gamekeeper's museum."—G. T. ROPE (Blaxhall, Suffolk).

Norfolk Plover (Ædicnemus crepitans) in Suffolk in November.—About the middle of November a Norfolk Plover was brought to my brother by a man whose dog had caught it in a hedge at Little Glemham, Suffolk. It had a broken leg, and was otherwise badly injured, having probably been disabled by a shot, and not picked up at the time. It was found necessary to destroy it on account of its crippled state. A few of these birds had occasionally been noticed by my brother in former years during the summer about some large open fields not far from his house.—G. T. ROPE.

Grey Shrike in Suffolk.—On November 13th I had a good view of one of these birds in a sandy lane near Blaxhall Heath. It alighted close to me on the top of a hedge soon after sunset, remaining long enough for me to get my glass to bear upon it. This spot is in summer rather a favourite haunt of the Red-backed Shrike.—G. T. ROPE.

Black Redstart in Cambridgeshire.—Whilst my son and I were on a visit to Cambridge on November 13th, we noticed a Black Redstart (*Ruticilla titys*) haunting the masonry on the west side of St. John's College. It was comparatively tame and frequently flew down to the ground within some thirty yards distant from where we stood. From its plumage it was probably an immature bird of the year.—J. STEELE ELLIOTT (Dowles Manor, Salop).

Late Nesting of the Swallow.—Cases of House-Martins with young in the nest as late as October very frequently occur, but I have never previously met with an instance of this with Swallows so late in the year. My friend Mr. R. Chase drew my attention to a nest in an outbuilding to his house at Bewdley, where the young still remained on the evening of October 10th. At this date practically all House-Martins and Swallows had left this neighbourhood, but a few of both species lingered on to October 16th, and an adult

and young Swallow were last seen on October 22nd, which were probably two of the above-mentioned birds.—J. STEELE ELLIOTT.

Occurrence of a Reeve (*Machetes pugnax*) in Staffordshire.—On October 30th, 1915, an adult Reeve was shot on the Sewage Farm, Leek, Staffordshire, by Mr. T. Whittles, and is being preserved for the collection of Sir Vauncey Harpur Crewe, Bart. Former records of this species in the county are:—Two in immature plumage were shot near Burton-on-Trent in 1857 (Sir Oswald Mosley's 'Natural History of Tutbury,' p. 106); one at Norton Pool, Chasetown, July 10th, 1897, an adult male ('North Staffs Field Club Report,' 1910, p. 100); and one, a young Ruff, shot near Stafford, August 29th, 1910 ('N. S. F. C. Rept.,' 1911, p. 75).—JOHN R. B. MASEFIELD (Rosehill, Cheadle, Staffordshire).

Bird-Notes from Cardiff in 1915.—

March 6th.—Pair of Magpies and a Barn-Owl seen.

27th.—Barn-Owl, Kestrel, and Heron seen near St. George's.

April 5th.—Moorhen's nest with seven eggs on Peterston Moors.

10th.—Lapwings' eggs found.

17th.—Magpie's nest with three eggs at St-y-Nyll, and a Carrion-Crow's nest with six eggs at St. George's. Heron seen.

24th.—Snipe breeding near St-y-Nyll, two eggs being found. Owl's nest with two eggs at St. George's.

27th.—Cuckoo heard.

May 1st.—Several pairs of Snipe breeding near Stockland. Six Kestrels' eggs in a Crow's nest. Swift seen.

2nd.—Redstart's nest with two eggs near Radyr. One more Owl's egg at St. George's.

6th.—Corn-Crake heard.

8th.—Young Magpies.

13th.—Saw a cock Pheasant attacked by a pair of Lapwings, evidently because it approached too near their young.

15th.—Cuckoo's egg in a Hedge-Sparrow's nest.

22nd.—Heron seen.

25th.—One Oystercatcher's egg found on Sully Island.

27th.—Four young Barn-Owls at Fairwater.

31st.—Sparrow-Hawk seen.

June 6th.—Young Sedge-Warblers.

13th.—Five more Owl's eggs at St. George's, making altogether a clutch of eight.

20th.—Two pairs of Red-backed Shrikes breeding within a few

yards of one another near Radyr Chain. Lesser Whitethroat's nest with four eggs.

27th.—Herring-Gull's nest on Sully Island.

July 10th.—Found Kingfisher's nest with eight eggs.

13th.—Saw a Common Sandpiper at the furze.

27th.—Owl seen. I also saw one on 2nd and 21st of this month.

August 1st.—Hawfinch seen in St. Fagan's Park.

14th.—Several Reed-Buntings noted near Glan Ely. Young Kingfisher seen.

October 2nd.—Saw a Grey Wagtail.

November 10th.—Several Marsh Tits seen near St. Lytham.

December 5th.—Lesser Spotted Woodpecker seen in the field adjoining the weir at Llandaff, and close to the spot where I found a pair breeding a few years ago.—J. S. BLAKE (59, Llanfair Road, Cardiff).

Variations in Wood-Pigeon.—This spring I bought at a poultreer's at Forest Hill, S.E., a variety of the Wood-Pigeon (*Columba palumbus*) with the primary quills and the tail silver-grey, the latter crossed by numerous narrow indistinct dark grey bands in the place of the broad black terminal bar. Some years ago I got a close view at the Zoo of a specimen in which this bar was replaced by a silver-grey one, and one wing showed a patch of this hue. I have also seen in Regent's Park on two occasions a bird with one conspicuous white feather in one wing—a large covert, or one of the innermost secondaries; and in St. James's Park one with the neck-patch wanting on one side and only about half the normal size on the other. This was adult, but rather small, and short in the bill.—F. FINN.

NOTICES OF NEW BOOKS.

Vigour and Heredity. By J. L. BONHOTE, M.A., F.L.S., F.Z.S.
London : West, Newman & Co. 1915. 10s. 6d. net.

MR. BONHOTE is one of the zoologists—a very small number at present unfortunately—who specially concern themselves with the experimental study of animal life, and he brings to this pursuit that natural liking for keeping animals which is indispensable to successful results ; he is, in fact, a scientific fancier,

and the details of management he gives with regard to the keeping of such different creatures as Rats and Ducks are just what we should expect of him. His range of experimental work is wide ; either alone or with the help of friends he has bred and studied not only the above-mentioned animals, but Dogs, Cats, Pigeons, and African Desert-Mice (*Meriones*). Details of these experiments are very full, and his book becomes one of those indispensable for all students of heredity, for, although many of the results have appeared in papers in scientific publications, it is important to have them collected ; and the author's discussion of rival theories is full and fair. The illustrations are full and good ; three of them, representing some of the multiple hybrid Ducks for which this experimenter is well known, being in colour, while it may be mentioned incidentally that the book is of handy size and well printed on a good paper. Mr. Bonhote's conception of vigour in animals is that it is comparable to "steam in a boiler that must express itself in some form of energy, and the higher the pressure the greater the energy. Nature has several safety valves ; the chief and the one first used is outward expression in colour, or in restless energy (song, emigration, exercise, intellect, play, &c.) ; these, however, are minor outlets. If, in spite of these, the vigour still rises, sexual intercourse takes place, and the vigour of the resulting young is, if we may so express it, analogous to the steam pressure in the second cylinder." The characters of the young will depend on the vigour of the parents at the time of mating, and many very interesting instances of this are given in the experimental details, which also tend to discredit Mendelism as an universal explanation of the facts of inheritance. The notion of sex-developments as a safety-valve was enunciated rather fancifully by J. G. Wood many years ago, and we are glad to find so up-to-date an investigator as Mr. Bonhote scientifically confirms him.

Where our author deals with non-experimental evidence, he at times shows, like many zoologists even nowadays, a tendency to make too-sweeping statements, as, for instance, where he credits all Arctic animals, whose vigour he considers low, with a want of very marked sexual differences, quite overlooking the very conspicuous ones found in the Narhwal, Harp-Seal, Bladdernose, and the Long-tailed and Eider Ducks.

The Auk. Vol. xxxii. Nos. 3 and 4. American Ornithologists' Union, Cambridge, Mass. July and October, 1915. 75 cents each.

THE last of these two numbers of this quarterly journal of American ornithology completes the volume and contains the index, and some interesting papers and notes. Conspicuous among these are Mr. Outram Bangs's "Notes on Dichromatic Herons and Hawks," in which he, rightly in our opinion, pleads for the suppression as species of some of the various white or rufous phases of well-known forms which have been allowed specific rank in the past, such as the Great White Heron of Florida, which accumulated evidence shows to breed freely with coloured forms; and Mr. C. E. Johnson's very complete and careful study of what he calls a four-winged Wild Duck—the precise species is the Green-winged Teal (*Nettium carolinense*) which is hardly more than a subspecies of our familiar little bird. The subject was a female, and "had no difficulty in flying, but was peculiar from the fact that it flew out from some thick grass bordering a small creek back in the woods," and had failed to migrate with the rest of its species. The supernumerary wings sprang from the under side of the true wings at the region of the elbow; they were dwarfed and without quills, their covering being of the character of under wing-coverts.

In the July number there is an admirable paper on the Rock-Dove, which Dr. C. W. Townsend, the author, calls *Columba domestica*, which name, according to Stejneger, must replace *C. livia* for the familiar Blue Rock! This bird, it seems, has become feral in American cities as well as in Europe, having, of course, been originally introduced in a domestic state. In America there has evidently been a much more complete reversion to the typical colour than here, because Dr. Townsend finds the blue rock colouration the dominant one, which it certainly is not in London at all events, or in any English town we know of. Blue birds were, however, also dominant in Calcutta in our time, but here there may have been an intermixture with the Eastern race of the Rock-Dove (*C. intermedia*), which in India frequents inhabited places as well as rocky wilds. Albinism seems more common in feral American Pigeons than in English ones, but appears to be eliminated by Hawks in country places.

British Birds. By A. THORBURN. Vol. II. London: Longmans, Green & Co. 1915. £1 11s. 6d.

IN this volume of his magnificent work Mr. Thorburn finishes off the Crows and deals with the Larks, the Swifts, Cuckoos, &c., the birds of prey, the Cormorant and Gannet, and most of the Heron family. With regard to his treatment of these birds, both as regards the pictures and the letterpress, we must accord, as a rule, the same praise to it as we did to his first volume reviewed in the 'Zoologist' last April. Of course, as the birds dealt with in the present volume are so much more picturesque than most of the Passerines, one expects the illustrations to be more imposing than those in the first volume, and this is generally the case. The figures of the Golden Eagle and the Eagle-Owl, which occupy respectively whole pages, are well worth framing as pictures, especially the latter, which is the finest plate in the book in our opinion. In some cases the illustrations are not quite happy; the attitude of the Roller is far too Jay-like, this bird having more the pose of the Spotted Flycatcher when perched; and the Bee-eater figure has a serious mistake in it, the foot being drawn like a Swallow's, whereas it resembles that of the Kingfisher, with joined front toes and comparatively short hinder ones.

The Herons are a beautiful group, but the Cormorants are less good; artists do not seem to realize the essential picturesqueness of these weird, old-world-looking birds. The Cuckoo is presented to us as calling with the bill closed, but this, Mr. Thorburn assures us, he knows to be correct from personal observation, his attention having first been drawn to the point by Wolf many years ago.

A very interesting point noted is Mr. Thorburn's observation that a melanistic Montagu's Harrier in Lord Lilford's possession had the iris dark like a Falcon's; such correspondence of iris with plumage-colour in dark varieties not being by any means universal, black fowls usually having normal eyes, and black Pigeons always normal or even light ones.

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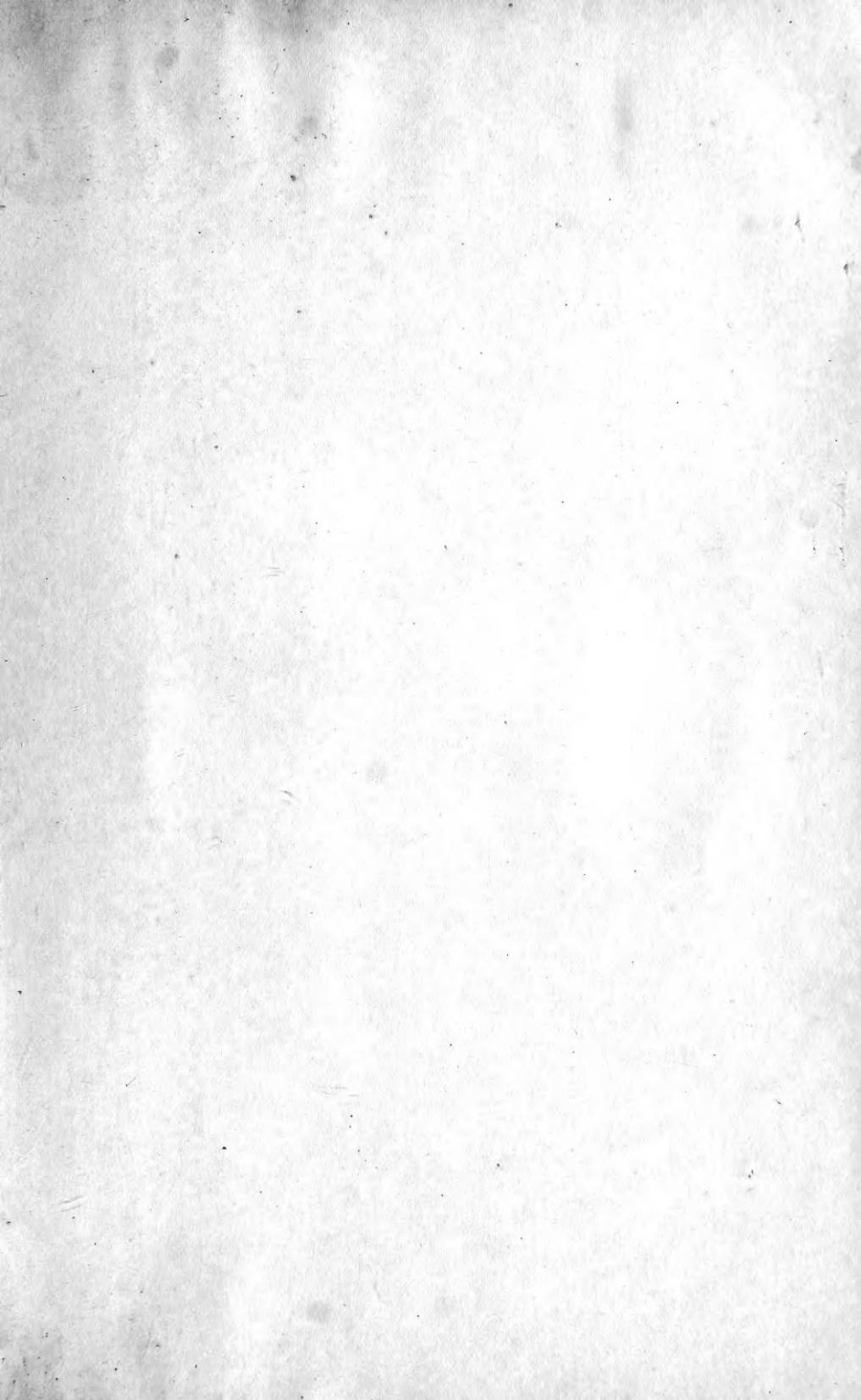
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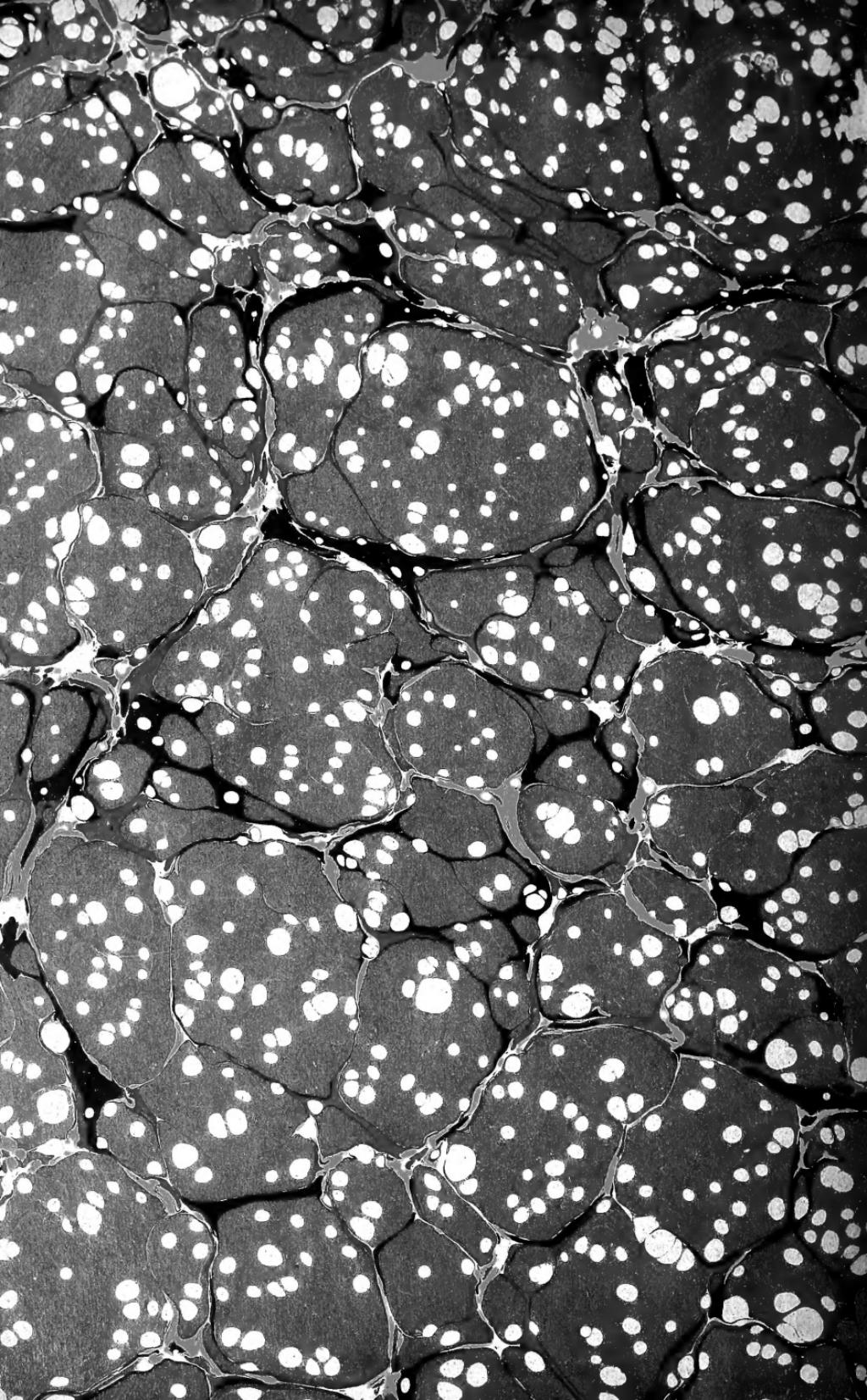


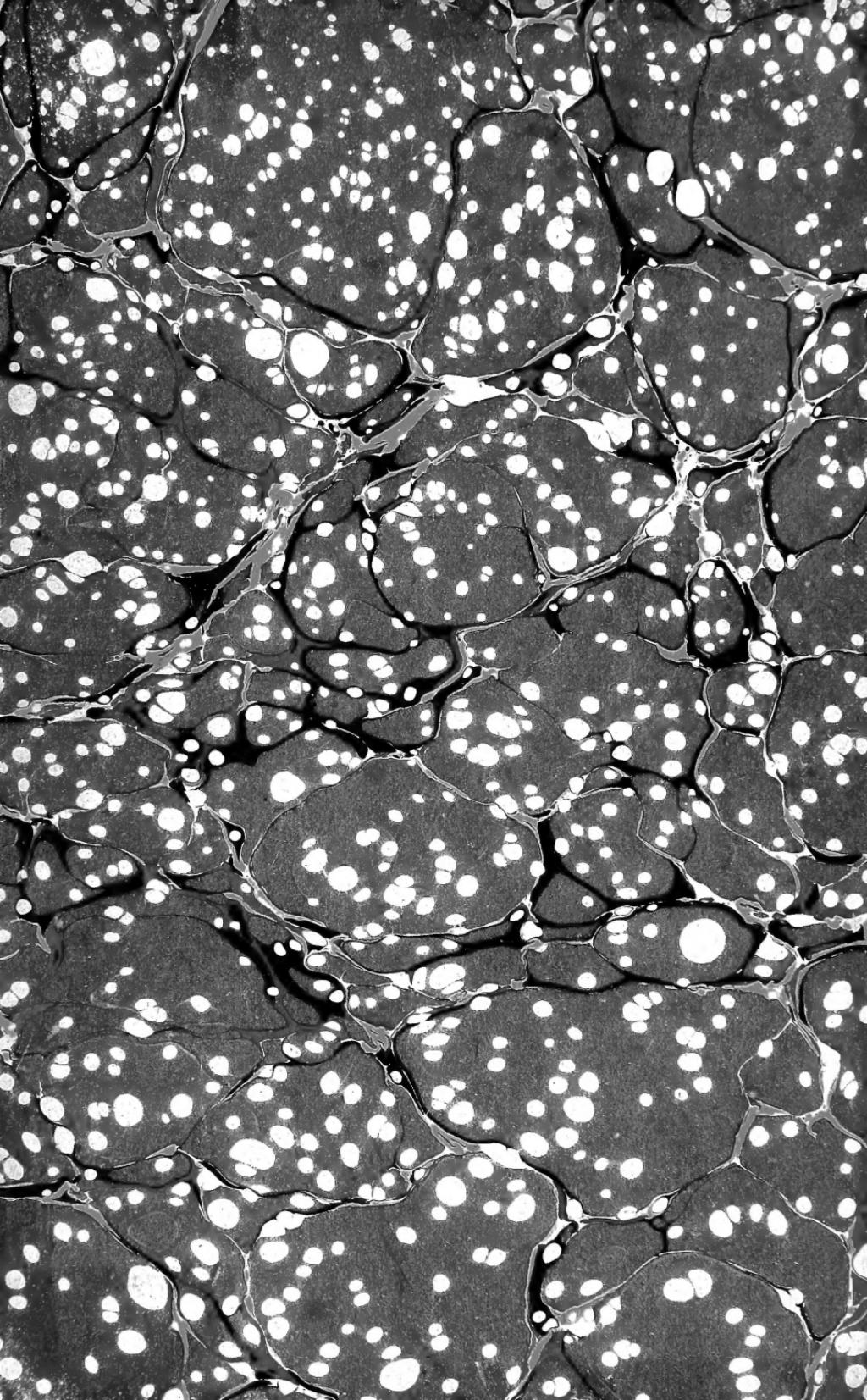












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